THE PLANT DISEASE REPORTER

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SUPPLEMENT 161

STUDIES ON VEGETABLE SEED TREATMENTS
IN 1944

June 1, 1946

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station Beltsville, Maryland

STUDIES ON VEGETABLE SEED TREATMENTS IN 1944

Report by Vegetable Seed Treatment Sub-Committee
of the Seed Treatment Committee of the
American Phytopathological Society

Plant Disease Reporter
Supplement 161

June 1, 1946

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I. SCOPE OF 1944 TEST AND FUTURE PLANS

C. M. Haenseler

Cooperative Tests in 1944

Cooperative vegetable seed treatment tests, started in 1940 under the direction of a committee appointed for that purpose by the American Phytopathological Society, were continued in 1944 for the fifth consecutive year. During 1944 data were obtained from a total of 236 individual tests conducted with 10 vegetable crops by 42 cooperators located in 30 States and 2 Canadian Provinces as listed in Table 1.

In each crop except onions, seeds from a single lot were treated with various seed protectants and distributed to the several cooperators who planted them in five replications of 100 seeds each for each of the treatments and an untreated check lot.

In most of the tests data on seedling emergence only were obtained but records on weak seedlings and on damping-off were included in a few cases. With onions the tests were of two types, one on seed decay and damping-off, the other on smut control.

Plans for the Future

At a meeting of the crop leaders held in Cincinnati during the Annual Convention of the American Phytopathological Society, December 1944, it was unanimously agreed that the type of cooperative tests conducted by our committee during the past five years should not be continued in 1945, and probably not soon thereafter. It was thought that the purpose for which the tests were originally planned had been largely accomplished. Large scale testing might well be resumed by the group, however, as soon as we have several new seed protectants which have been carefully studied by one or more individuals. These preliminary studies should establish the approximate dosage, dustability, phytotoxic properties, and ease of handling, before distribution to a large number of cooperators.

The committee recognized that many questions relating to seed treatment problems still remain unsolved but it was thought that most of these could be more efficiently studied by individuals than by large scale cooperative testing. Such problems as control of seed-borne diseases, effect of seed treatment on crop yield, and compatibility of certain seed protectants with legume inoculants, etc., require intensive study, whereas our large group of cooperators could be expected to conduct only simple tests which could be added to their regular program without serious interference with their own work.

After considering all these angles all of the crop chairmen agreed that it would be best to discontinue the cooperative vegetable seed treatment tests for the time being and to reorganize the group if desirable after preliminary tests conducted by various individual workers had revealed several new materials which seemed to have specific advantages over those so thoroughly tested during the past five years.

The committee hopes to function as a clearing house for the time being and will attempt to assemble miscellaneous information on new seed protectants from time to time. When several prospective materials have been tested locally and found to have specific advantages over the standard treatments the committee may again call on cooperators in the various states to give the new materials a thorough nation wide test. There may be sufficient data available on several new products to warrant a large scale cooperative test again in 1947 or possibly 1948.

Accomplishments To Date

The results obtained from the five years' cooperative test just concluded have gone far beyond their original intention, viz. comparison of the relative efficiency of several seed protectants for vegetable seeds. They have not only established the relative efficiency and the optimum dosages of the various seed protectants now commercially available for use on vegetable seeds, but they have had many other direct and indirect effects in addition. For example, they demonstrated that a large group of independent workers can cooperate advantageously in solving certain types of problems that lend themselves to this method of testing; they have encouraged the adoption of uniform interstate recommendations for vegetable seed treatments, a very significant accomplishment; they have greatly stimulated interest in vegetable seed treatments among growers; they have impressed seedsmen with the importance of seed treatment and have encouraged some of them to offer treated seeds to the trade. These accomplishments have made the cooperative tests of value not only to the seedsman and to the vegetable grower but also to the cooperators and we hope to the field of Plant Pathology as a whole.

We should like to thank each of the many cooperators and each of the various crop leaders and committee members who worked so well together to make these tests a success. They all deserve credit for the spirit in which they worked together toward a common goal. We know they will respond again if the need arises.

NEW JERSEY AGRICULTURAL EXPERIMENT STATION

Table 1. Cooperative vegetable seed treatment tests conducted in 1944.

Serial no.	Cooperator: State	Cooperator: Name	Number of tests: Beets	Carrot	Cucumber	Lettuce	Onion	Pea	Soybean edible	Spinach	Sweet corn	Tomato	Total
1	Ark.	J. Ralph Shay								1			1
2	Calif.	L. D. Leach	1	1			1	2		1			6
3	Conn.	A. M. Porter	1	1	1		1			1	1	1	7
4	Del.	J. W. Heuberger						1		1	1		3
5	Fla.	A. N. Brooks								1	1		2
6	Fla.	W. B. Tisdale							1				1
7	Fla.	G. R. Townsend	1	1				2					4
8	Ga.	G. E. Thompson	2	1		1				2		1	7
10	Idaho	G. K. Knight					2	2		1			5
12	Ind.	C. M. Smith									1		1
13	Iowa	R. H. Porter	1	1				2	1		1		6
14	Md.	C. E. Cox	1		1	1	1	2		1	1	1	9
15	Md.	S. P. Doolittle & F. S. Beecher			1							1	2
16	Mass.	O. C. Boyd & B. T. Sproston					*1						1
17	Mass.	E. F. Guba & E. V. Seeler	1	1	1	1	1	2	1	1	1		10
19	Mich.	J. H. Muncie	1		1			2		1			5
20	Minn.	C. J. Eide	1	1				2		1	1		6
22	Neb.	M. W. Felton & A. E. Dimond	3								3		6
23	N. J.	B. H. Davis		1	1			2	1	1	1	1	8
24	N. Y.	W. T. Schroeder	1					4		1	1		7
25	N. Y.	F. M. Gordon	1	1		1			1	1	1	1	7
26	N. Y.	A. G. Newhall & W. Erader		1			1						2
27	N. C.	D. E. Ellis & M. F. Buell	1	1	1		1	2	1	1			8

Serial no.	Cooperator: State	Cooperator: Name	Number of tests: Beets	Carrot	Cucumber	Lettuce	Onion	Pea	Soybean edible	Spinach	Sweet corn	Tomato	Total
28	N. D.	W. E. Brenzel							1	1			2
29	Ohio	J. D. Wilson	2				1	2	1	2	1		9
30	Okla.	J. H. McLaughlin	3	3	1	2		4	1	3	3		20
31	Oreg.	F. P. McWhorter & P. W. Miller	1				*1			1			3
32	Pa.	W. S. Beach	1	1				2	1	1	1		7
33	Pa.	R. P. Porter			1				1	1	1	1	5
33.1	R. I.	F. L. Howard					1						1
34	S. C.	C. N. Clayton	1		1	1			1	1	1		6
35	S. C.	C. J. Nusbaum	1			1	1	2	1	1	1	1	9
36	S. D.	C. M. Nagel	1					2		1	1		5
38	Va.	G. K. Parris	2	1	3	1		5	2	3	3	2	22
39	Wash.	C. J. Gould		1	1				1				3
40	Wash.	L. K. Jones				1		2			1	1	5
41	W. Va.	J. G. Leach & C. F. Taylor			1			1	1	1		1	5
42	Wis.	J. E. Kuntze						2		1			3
43	Wis.	J. C. Walker	2	1				2		1			6
44	Wyo.	G. H. Starr						2		1	2		5
45	Canada	G. A. Scott & R. G. Atkinson						2		1	1		4
46	Canada	Irene Mounce	1	1									2
Total number of tests			31	19	15	10	13	53	17	36	30	12	236

* Tests conducted on smut control

II. GARDEN BEET SEED TREATMENTS

L. D. Leach

Garden beet seed of the variety Detroit Dark Red was treated with Arasan at 3 different dosages and with Ceresan and Yellow Cuprocide at one dosage each and planted along with nontreated seed in 5 replications of 100 seedballs per row.

Thirty-one tests were completed by cooperators in 23 experiment stations and the results are presented in Tables 2 and 3. The 1944 tests are remarkable in that 25 out of the 31 tests showed significantly higher emergence from treated than from nontreated seed.

The best evidence of the effects of the different seed treatments is obtained by analyzing the combined data from the tests[1]. To produce a homogeneous group it is necessary to eliminate the following 5 tests: 43A because of high variance, and 8A, 27, 35 and 38B because of low variance. Two of these would also be eliminated because severe crusting of the soil prevented satisfactory emergence of the seedlings. The averages and statistical analysis for the 26 tests representing a homogeneous group are as follows:

Number of Tests	Average number of seedlings						Average error variance	"F" Value
	Arasan			Ceresan	Yellow Cuprocide	Non-treated		
	0.25%	0.5%	1.0%	1.0%	1.5%			
26	63.7	69.5	72.9	63.3	65.1	32.2	143.9	193.77

Significant difference 19:1 odds - 2.93; 99.1 odds - 3.86.

It is clearly evident that all treatments increased the emergence of beet seedlings significantly as compared with the nontreated. There is no significant difference between Arasan at 0.25%, Ceresan at 1.0%, and Yellow Cuprocide at 1.5%. Higher dosages of Arasan, 0.5% and 1.0%, were

[1] Roessler, E. B., and L. D. Leach. Analysis of combined data for identical replicated experiments. Proc. Amer. Soc. Hort. Sci. 44: 323-328, 1944.

Table 2. Location, time, and environmental conditions of garden beet seed treatment tests, 1944.

Test no.	Locality	Planting date	Soil conditions: Type	Soil conditions: pH	Soil conditions: Moisture	Precipitation	Air temperature: Max.	Air temperature: Min.	Days to emerge
						in.	°F	°F	
2	Calif.	2/14	Fine sandy loam	6.8	Optimum	3.01	58.6	35.2	15
3	Conn.	5/20	Sandy loam	6.2	Very wet	0	88.8	62.9	5
7	Fla.	2/19	Peat	6.2	Dry	0	86.3	55.0	6
8A*	Ga.	3/8	Sandy loam	5.6	Optimum	W	88.7	52.2	-
8B	Ga.	3/25	Cecil clay	5.7	Optimum	3.64	69.5	42.9	-
13	Iowa	4/17	Heavy	-	Very wet	-	-	-	-
14*	Md.	10/7	Sandy loam	5.6	Optimum	W	93.4	51.8	6
17	Mass.	4/18	Gravelly sandy loam	6.07	Optimum	1.96	62.6	34.6	-
19	Mich.	4/29	Sandy loam	7.2	Optimum	1.16	62.2	43.8	11
20	Minn.	5/15	Silt loam	5.5	Optimum	3.03	75.5	56.7	15
22A	Nebr.	5/1	Clay loam	7.4	Optimum	1.33	70.0	50.2	-
22B	Nebr.	5/26	Clay loam	7.4	Dry	3.54	77.8	59.9	-
22C	Nebr.	8/7	Clay loam	7.2	Dry	1.24	90.8	68.4	-
24	N.Y.(G)	5/1	Silty clay loam	7.09	Dry	2.88	76.6	50.9	8
25	N.Y.(I)	5/10	Black sandy loam	6.15	-	0.48	75.9	58.9	5
27	N. Car.	4/7	Norfolk sandy loam	5.61	Wet	4.08	-	50.8	-
29A	Ohio	4/22	Silt loam	6.8	Wet	3.14	-	-	-
29B	Ohio	4/26	Muck	5.8	Optimum	-	-	-	-
30A	Okla.	3/24	Fine sandy loam	5.14	Optimum	0.38	63.6	38.9	-
30B	Okla.	3/25	Loam	6.17	Optimum	1.86	66.8	39.0	-
30C*	Okla.	3/26	Sandy loam	-	Wet	W	73.0	64.6	-
31	Oreg.	3/15	Clay loam	6.0	Dry	0.77	59.8	36.3	17
32	Pa.	4/29	Clay loam	7.0	Optimum	4.63	77.1	50.7	9
34	S.C.(Ch)	3/2	Sandy loam	5.1	Optimum	5.01	66.9	43.2	10
35	S.C.(Bl)	3/27	Sandy loam	5.72	Wet	1.48	62.9	43.1	7
36	S.Dak.	5/22	Barnes loam	6.5	Wet	0	81.5	54.7	-
38A	Va.	2/23	Loamy sand	5.85	-	7.13	57.1	37.9	17
38B	Va.	4/11	Sandy loam	6.2	Optimum	2.37	74.0	50.4	13
43	Wisc.	5/24	Silt loam	6.4	Optimum	2.92	81.9	64.2	-
46*	Can.(B.C.)	5/31	Compost	-	Optimum	W	83.9	53.9	-

* Planted in greenhouse; all others in field.

Table 3. Effect of seed treatment on emergence of garden beets.

Test no.	Report from: Locality	Average number of seedlings per 100 seedballs: Arasan 0.25%	Arasan 0.50%	Arasan 1.0%	Ceresan 1.0%	Yellow Cuprocide 1.5%	Non-treated	Significant Difference[a]	Calculated "F" value
2	Calif.	63.2	50.0	58.2	57.8	52.4	25.0	14.17	8.03
3	Conn.	40.6	63.4	71.0	51.4	25.2	15.6	17.52	12.38
7	Fla.	48.8	52.0	50.6	45.8	43.0	24.0	12.24	6.22
8A	Ga.	64.0	63.0	65.4	69.0	64.0	52.0	7.42	5.19
8B	Ga.	29.0	31.8	21.8	18.0	13.8	8.8	11.82	4.84
13	Iowa	40.4	35.6	46.4	31.8	36.6	22.8	10.30	5.36
17	Mass.	99.6	102.6	109.6	87.8	113.6	30.6	17.74	26.14
19	Mich.	38.4	45.0	56.8	34.8	50.8	7.0	14.68	12.30
20	Minn.	39.0	58.4	43.2	41.0	35.0	14.6	13.8	9.25
22A	Nebr.	81.0	72.8	80.4	82.6	66.6	27.8	14.3	18.4
22B	Nebr.	48.2	43.4	49.6	45.0	37.0	14.4	17.5	4.9
24	N.Y.(G)	61.8	60.2	75.8	67.8	76.4	39.4	18.70	4.63
25	N.Y.(I)	72.4	89.0	104.6	68.0	89.8	23.8	14.47	32.97
29A	Ohio	50.4	56.2	60.8	53.2	47.4	32.4	10.02	8.35
29B	Ohio	59.8	72.0	71.2	49.6	56.2	34.2	18.81	4.96
30A	Okla.	85.8	89.2	95.6	81.4	85.6	41.0	17.46	9.39
30B	Okla.	82.2	73.8	72.6	75.4	72.2	46.6	15.31	5.57
30C	Okla.	111.8	133.6	132.4	125.6	123.0	19.6	16.85	58.94
32	Pa.	99.6	105.6	116.0	108.2	113.6	77.2	15.69	6.98
34	S.C.(Ch)	63.2	77.6	73.4	72.4	65.4	40.2	21.68	3.34
35	S.C.(Bl)	91.4	97.0	105.0	99.2	102.8	77.2	4.88	37.31
36	S. Dak.	52.4	75.2	79.0	38.2	76.0	40.6	13.04	18.01
38A	Va.	48.2	56.2	58.2	46.2	62.0	19.2	16.27	7.80
43B	Wisc.	40.6	37.2	36.6	31.8	34.4	16.6	15.64	4.82
46	Can.(B.C.)	131.4	133.8	137.0	135.6	130.8	61.6	15.19	32.8
Average Significant tests:		64.6	71.0	74.8	64.7	66.9	32.4		

Report from		Average number of seedlings per 100 seedballs						Signif-	Calculated
Test no.	Locality	Arasan			Ceresan	Yellow Cuprocide	Non-treated	icant Differ-ence [a]	"F" value
		0.25%	0.50%	1.0%	1.0%	1.5%			
14	Md.	45.8	53.2	50.4	59.4	52.4	34.6	N.S.	1.39
22C	Nebr.	46.4	30.2	37.8	39.4	33.6	33.0	N.S.	1.8
27	N.Car.	9.2	12.4	13.4	8.6	13.6	2.4	N.S.	2.17
31	Oreg.	104.6	109.4	105.6	98.6	99.4	89.0	N.S.	1.72
38B	Va.	4.0	4.4	5.6	4.0	5.6	2.6	N.S.	0.5
43A	Wisc.	34.2	43.6	32.0	50.0	23.0	36.0	N.S.	0.99
Average Non-significant tests:		40.7	42.2	40.8	43.3	37.9	32.9		
AVERAGE ALL TESTS		60.0	65.4	68.2	60.6	61.3	32.5		

[a] Differences required for significance between means --- Odds 19 : 1.

significantly better than all other treatments. The 1.0% dosage of Arasan exceeded the 0.5% dosage at the 5% but not at the 1% level of significance.

The emergence from Ceresan-treated seed was significantly lower than from that treated with Arasan in 8 individual tests. The fact that in 7 of these tests the seed was planted 80 to 110 days after treating suggests that in some cases chemical injury to the seed during storage may have influenced the results. Delay of emergence was reported in one test each for seed treated with Ceresan and Yellow Cuprocide.

Only 6 cooperators reported the chief causal organism. Five found Pythium and one Rhizoctonia to be responsible for most of the infection in their tests.

The contrast between the 1943 and the 1944 cooperative tests is particularly noticeable. In 1943 only 2 out of 19 tests showed significant improvement in stand from seed treatment, while in 1944 with 6 of the same treatments, 25 out of the 29 tests in which conditions were satisfactory for germination showed significant improvements from seed treatment. On the average the 1944 tests were conducted at slightly lower temperatures and with somewhat more rainfall during the germination period than in 1943, but these factors do not appear to explain the results. Cooperators will remember that the information sheet accompanying the 1944 seed packets contained the following statement: "For the 1944 test a seed lot of Detroit Dark Red that appears highly susceptible to damping off and that shows a mean emergence period significantly longer than the 1943 seed lot has been selected."

In the writer's opinion the differences in vitality and susceptibility of the two seed lots are chiefly responsible for the difference in results of the two years. This opinion is supported by the similarity of the average of all cooperative tests and results obtained in tests under controlled conditions. The results, therefore, illustrate the important effect that quality of seed may exert in seed treatment tests.

Conclusions: In most of the tests conducted in 1944, seed treatment with Arasan, Ceresan, or Yellow Cuprocide significantly increased the emergence of Detroit Dark Red garden beets. Arasan at dosages of 0.5% and 1.0% gave the best results. Whether the differences between these two justify the use of the 1.0% dosage is not clear. The striking benefits from seed treatment in the 1944 tests in contrast to the limited benefits in 1943 are attributed chiefly to differences in vitality and susceptibility of the two seed lots.

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III. CARROT SEED TREATMENTS

B. H. Davis

Cooperative seed protectant tests were conducted on carrots for the first time in 1944. The following protectants and dosages were tested on the variety Chantenay: Arasan and Spergon at .5 and .75%, Semesan at .42%, and red copper oxide and zinc oxide at 1% by weight of seed. Data were received from 19 of the 22 lots of seed planted by 18 cooperators in 16 States and one Canadian Province. Of the 19 tests 8 showed significant differences between treatments at the 5% level. A summary of the environmental conditions in these 19 locations are given in Table 4 and a summary of the seedling counts and statistical significance are shown in Table 5.

An analysis of combined data produced a homogeneous group[1] if tests 38, 3, 39, and 26 are omitted. The averages and statistical analysis for the 15 tests follow:

No. of tests	Average number of seedlings								Average error Variance	"F" Value	L.S.D.*
	Arasan .5%	Arasan .75%	Spergon .5%	Spergon .75%	Semesan .42%	Red Copper Oxide 1%	Zinc Oxide 1%	Check			
15	25.9	27.1	24.1	23.3	22.4	24.5	22.7	20.3	30.67	9.00	2.0

* Least difference required for significance at 5% level.

In these 1944 tests seed treated with all the above protectants at the dosages indicated produced a significantly greater number of seedlings than the control. The best material was Arasan which at the .75% dosage was significantly better than all other materials and at the .5% dosage was better than all except red copper oxide, and Spergon at .5%. No significant difference was obtained between the two Arasan dosages. With the exception of red copper oxide which was significantly better than Semesan, no significant differences occurred between any of the other materials.

[1] Roessler & Leach, see page 6.

Table 4. Location, time and environmental conditions of cooperative carrot seed tests conducted in 1944

Coop. no.	Locale	Planting date	Planted in*	Soil pH	Soil Moisture at planting	Soil Type	Germination Period[b] Total precipitation	Mean air temperature Min.	Mean air temperature Max.	No. of days to emergence[a]
							in.	°F	°F	
39	Wash.	4/1	F	5.5	Optimum	Sandy Loam	2.44	39	59	-
26	N. Y.	6/25	G Bed	5.7	Optimum	Muck	**	67	103	-
46	Canada	4/21	G	-	-	Compost	**	59	88	8
8	Ga.	3/11	Gard.	5.7	-	Cecil Clay	4.70	41	68	-
30A	Okla.	3/7	G Bed	7.14	Wet	Clay Loam	**	65	72	7
17	Mass.	4/26	F	6.07	Wet	Sandy Loam	.39	42	71	14
25	N. Y.	5/10	F	6.15	Optimum	Sandy Loam	.49	57	74	15
30B	Okla.	3/14	F	6.17	Dry	Loam	2.08	37	58	-
27	N. C.	4/7	F	5.61	Wet	Sandy Loam	4.08	51	75	-
30C	Okla.	3/24	F	5.14	Optimum	Sandy Loam	.26	38	63	-
13	Iowa	4/17	F	7.0	Wet	-	-	-	-	-
43	Wisc.	5/17	F	6.40	Optimum	Silt Loam	2.25	61	79	10
2	Calif.	9/4	F	6.8	Wet	Sandy Loam	-	58	99	10
3	Conn.	5/20	G Bed	6.2	Very Wet	Sandy Loam	-	64	85	8
20	Minn.	5/15	F	5.5	Optimum	Silt Loam	.99	56	74	-
38	Va.	2/23	F	5.85	Optimum	Sandy Loam	3.77	37	56	22
32	Pa.	5/16	Gard.	6.9	Optimum	Clay Loam	3.18	56	78	10
23	N. J.	5/1	F	5.25	Optimum	Sassafras Loam	1.97	56	78	15
7	Fla.	2/22	F	6.2	Dry	Everglades Peat	-	54	85	10

NOTE: * F-field; G-greenhouse; Gb-greenhouse benches; G Bed-greenhouse beds; Gard.-garden.

** Watered

a "No. of days to emerge" was taken as the time between planting and time when majority of seedlings had emerged.

b When sufficient data were supplied the "germination period" was arbitrarily considered as 50% longer than "number of days to emerge" in order to include data on moisture and temperatures during the period of post-emergence damping-off. In some cases the environmental data were supplied only to the time when the majority of seedlings emerged.

Table 5. Summary of cooperative carrot seed treatment tests analyzed as randomized block tests - 1944

Coop. no.	Locality	Arasan .5%	Arasan .75%	Spergon .5%	Spergon .75%	Semesan .42%	Red copper oxide 1%	Zinc oxide 1%	Check	Diff. req. for sign.[a]	Calculated "F" value
39	Wash.	14.6	7.0	14.4	3.2	11.6	6.8	2.8	1.6	3.20	25.87
26	N. Y.	47.6	54.8	49.2	46.8	52.4	52.0	49.4	50.0	2.38	10.40
46	Canada	54.0	52.4	45.8	47.6	36.0	44.0	35.4	35.8	6.74	10.32
8	Ga.	19.6	23.0	17.4	18.2	8.8	14.0	12.2	11.8	5.86	5.42
30A	Okla.	41.6	50.4	37.0	32.4	39.2	34.4	37.2	28.0	4.85	3.79
17	Mass.	40.4	42.2	41.8	40.0	39.0	44.8	45.2	30.8	7.07	3.40
25	N. Y.	39.4	48.8	33.2	30.0	33.6	36.8	35.8	35.0	9.48	2.98
30B	Okla.	26.8	29.8	26.0	24.4	23.8	23.4	16.6	18.6	8.04	2.39
27	N. C.	4.4	4.0	5.0	3.0	5.0	9.2	9.0	5.6	N.S.	1.65
30C	Okla.	22.6	25.2	17.8	25.0	17.6	22.8	18.8	17.2	N.S.	1.54
13	Iowa	16.0	15.4	14.2	18.6	14.4	17.0	16.8	9.2	N.S.	1.40
43	Wisc.	10.8	7.2	8.0	3.0	11.6	8.2	8.0	4.2	N.S.	1.38
2	Calif.	16.6	16.0	18.0	14.4	19.6	12.0	11.0	18.8	N.S.	1.10
3	Conn.	31.8	33.0	27.0	33.6	35.6	28.2	25.2	27.2	N.S.	1.05
20	Minn.	15.4	17.2	22.6	19.6	13.8	16.8	14.0	16.8	N.S.	.96
38	Va.	45.6	44.8	47.8	40.6	38.8	45.8	41.6	39.2	N.S.	.82
32	Pa.	41.4	42.4	39.8	39.0	41.2	44.4	43.6	38.0	N.S.	.56
23	N. J.	24.4	22.2	21.2	23.6	19.6	26.2	25.4	25.0	N.S.	.54
7	Fla.	15.2	10.4	14.2	11.0	13.2	13.6	11.4	9.6	N.S.	.47

[a] Least difference required for significance at 5% level.

Counts on post-emergence damping-off were made by three cooperators. Although the percentage of seedlings with damping-off was lowest in the Arasan treated plots, the data are too meager to draw definite conclusions. Further data on damping-off were furnished from one other test (No. 26, Newhall, N. Y.). Severe damping-off prevailed at the time the first counts were made. The significant differences between treatments reported for these counts were lost when a second count was taken 11 days later when all remaining plants appeared healthy.

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IV. CUCUMBER SEED TREATMENTS

S. P. Doolittle and F. S. Beecher

The cucumber seed treatment tests of 1944 were essentially a repetition of those of 1943 and were designed to test again the value of certain newer protectants as compared with others long in common use. A dust treatment with New Improved Ceresan was included because of some demand for a protectant that would also disinfect the seed surface. The use of New Improved Ceresan was suggested by recent work of B. H. Davis and C. M. Haenseler of the New Jersey Experiment Station, in which they showed the value of the New Improved Ceresan dust as a treatment for tomato seed.

The treatments used were: Arasan (0.3% by weight of seed); Yellow Cuprocide (1.0%); Spergon (0.3%); New Improved Ceresan (0.3%); Semesan (0.3%) and an untreated check. Seed of the variety "A and C" was used in the trials. Through the kindness of Mrs. Vivian K. Toole of the Bureau of Plant Industry, Soils, and Agricultural Engineering, tests of germination were made with seed samples from each treatment and the check, according to the rules of the Association of Official Seed Analysts. The tests were made during June 1944 and showed no significant differences in germination, the figures for the various samples ranging from 58.25 to 61.75 percent. It was evident that the seed used was low in germination, but it seemed possible that this might lead to more marked differences between protectant treatments.

The seed was treated at Beltsville, Maryland, and samples sent to the various cooperators. The tests were planted in 5 randomized blocks made up of 6 treatment plots of 100 seeds each. The data were recorded on the basis of total emergence.

Table 6 gives locations, time of planting, environmental conditions, and average number of days required for emergence of seedlings. The data on total emergence and their statistical significance are given in Table 7.

Table 8 shows the number of tests in which seedling emergence for any single treatment was significantly greater than that for any other treatment and indicates the relative value of the various treatments in this set of tests when compared in such a way.

Data were received for 16 trials conducted in 10 States. Five of these tests were conducted in the greenhouse and 11 in the field. One test was lost because of unfavorable conditions and 11 of the remaining trials did not show statistically significant differences. Three of the 4 significant tests had been planted in the greenhouse. In 1943, practically all of the tests, both in the field and greenhouse, showed significant differences and it would seem, therefore, that field conditions in 1944 were less favorable for damping-off.

Table 6. Location, time, and environmental conditions of cucumber seed treatment tests with the "A and C" variety in 1944

Report from Test no.	State	Planting date	Soil conditions: Type	pH	Moisture	Rainfall	Air temperature Min. - Max. °F	Days to emerge
3	Conn.	5/20	Sandy loam	6.2	Very wet	G.H.[a]	55 - 98	4
14	Md.	3/29	Sandy loam	5.6	Optimum	G.H.	38 - 94	9
15	Md.	4/10	Sandy loam	5.6	Optimum	G.H.	63 - 92	8
17	Mass.	6/1	Sandy loam	6.3	--	.94	39 - 88	9
19	Mich.	5/27	Sandy loam	7.2	Optimum	.92	45 - 85	--
23	N. J.	5/5	Sandy loam	5.8	Optimum	1.67	44 - 85	10
27	N. C.	4/18	Sandy loam	5.61	Wet	1.41	38 - 84	10
30	Okla.	5/9	Loam	6.17	Optimum	G.H.	51 - 91	6
33	Pa.	7/19	--	--	Very dry	--	--	9
34	S. C.	3/22	Sandy loam	5.1	Wet	5.51	29 - 84	15-18
38A	Va.	8/6	Sandy loam	5.9	Optimum	4.49	58 - 98	--
38B	Va.	4/6	Loamy sand	6.7	Wet-Opt.	G.H.	61 - 106	4
38C	Va.	4/21	Sandy loam	6.2	Optimum	.61	41 - 89	10
39	Wash.	5/16	Sandy loam	5.5	Optimum	.80	34 - 87	--
41	W.Va.	--	Clay loam	6.75	Optimum	1.05	50 - 94	12

[a] G. H. refers to greenhouse test.

Table 7. Emergence data for cooperative cucumber seed treatment tests analyzed as randomized block tests, 1944

Report from: Test no.	State	Average emergence from seed treated with: Arasan 0.3%	Yellow Cuprocide 1.0%	Spergon 0.3%	New Improved Ceresan 0.3%	Semesan 0.3%	Untreated check	Least significant difference[a]	Calculated "F" value
		%	%	%	%	%	%	%	
14	Md.	23.0	30.0	24.4	33.0	30.0	14.4	9.64	4.24
15	Md.[b]	48.2	43.0	56.0	38.8	53.2	15.0	5.79	56.66
17	Mass.	51.8	55.2	62.0	56.2	59.8	46.4	7.57	4.78
19	Mich.	42.6	43.0	32.8	35.6	39.8	25.6	6.28	9.9
3	Conn.	52.0	45.0	48.8	45.0	44.8	43.0	NS	0.63
23	N. J.	47.2	43.4	43.2	36.8	47.2	40.6	NS	1.854
27	N. C.	18.2	11.8	11.6	9.8	11.6	3.4	NS	1.81
30	Okla.	48.2	49.4	44.0	46.0	43.2	43.4	NS	--
33	Pa.	37.2	34.2	36.4	30.0	30.8	24.8	NS	--
34	S. C.	19.2	22.6	28.4	32.6	23.2	19.6	NS	2.45
38A	Va.	23.2	25.0	19.4	21.2	21.2	19.8	NS	0.56
38B	Va.	56.2	59.8	55.6	60.8	56.4	53.4	NS	1.9
38C	Va.	40.8	43.2	41.0	42.6	40.6	28.2	NS	1.06
39	Wash.	8.6	9.2	9.4	6.0	5.6	3.4	NS	1.74
41	W.Va.	9.2	9.4	10.0	9.8	10.2	8.2	NS	--

[a] At 5% point

[b] Soil known to be infested with *Pythium* spp.

Table 8. Relative value of different protectants in improving emergence from cucumber seed, 1944

Treatment used	Number of times a given treatment (Column 1) was superior to						Total[a] score
	Arasan	Yellow Cuprocide	Spergon	New Improved Ceresan	Semesan	Untreated Check	
Arasan	-	-	1	2	-	2	5
Yellow Cuprocide	-	-	1	1	-	4	6
Spergon	2	1	-	1	-	4	8
New Improved Ceresan (dust)	1	-	-	-	-	4	5
Semesan	1	1	1	1		4	8
Untreated check	-	-	-	-	-	-	0

[a] Maximum value 20

Some of the 1944 tests classed as non-significant show considerable differences in the means for certain treatments. Individual comparisons of a number of such differences within the individual tests have shown that in occasional instances they are statistically significant, although the great majority are not. The results of these comparisons did not affect the relative ratings of treatments as shown in Table 8.

In 2 of the 4 tests showing significant differences in emergence data, all treatments were significantly better than the untreated checks. In the remaining 2 tests, 4 of the 5 treatments were superior to the check. Differences in total scores of the treatments indicated that Semesan and Spergon were the most effective materials in 1944. Arasan, which in 1943 seemed definitely superior to other treatments, did not give particularly good results in the 1944 trials, while Spergon proved much more effective than in 1943. The treatment with New Improved Ceresan dust gave significantly better emergence than the checks in all 4 trials, but frequently was not so effective as certain other treatments. The value of this treatment for cucumbers can only be determined by further work.

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V. LETTUCE SEED TREATMENTS

G. K. Parris

During 1944, the following chemical seed treatments were tried on lettuce: red copper oxide (2% by weight), zinc oxide (2%), Semesan (0.2%), Arasan (2%), and Spergon (2%). Ten sets of data from 9 cooperators located in 8 states were submitted for summation and analysis. Five cooperators reported significant differences between treatments.

The data given in Table 9 indicate the geographical location and the key number of each cooperator, and the prevailing environmental conditions for each test.

In Table 10 are given the 10 tests, arranged in order of their respective error variances, and the mean percent seedlings emerged per treatment. To these data have been applied an analysis designed by Roessler and Leach (see footnote, page 6) which applies the Chi-square test to determine the homogeneity of data from different locations. Four tests, (numbers 40, 35, 25, and 30B) with low error variances fall into homogeneous group 1, four other tests (14, 33, 34, and 8) form homogeneous group 2, while tests 17 and 30A stand apart and distinct from each other, having still higher error variances.

Emergence

The least difference necessary for significance between the means of Group 1 is 3.5 seedlings (Table 11). Thus all seed treatments are significantly better than the control. Red copper oxide (2%) is the best treatment while Semesan is the poorest, but there is no significant difference between the copper oxide and Spergon, or between the copper oxide and Arasan.

In Group 2, the least difference necessary for significance is 6.0 seedlings. Here, unlike findings in Group 1, red copper oxide is of no benefit over the control, which is likewise true of Semesan and Arasan. Spergon continues to be significantly better, but is no better than the also significant zinc oxide treatment.

Tests 17 and 30A may now be considered. In both, significant differences between treatments were found by the respective cooperators; in test 17, Spergon, zinc oxide, and red copper oxide increased seedling emergence by significant amounts, but there was no significant difference between the 3 treatments, and in test 30A all treatments except zinc oxide increased emergence over the control, but none of the others was better than any other treatment.

Table 9. Location, time and environmental conditions of lettuce seed treatment tests - 1944.

Report from Test no.	Locale	Planting date 1944	Planted in [a]	Soil conditions pH	Soil conditions Moisture	Rainfall inches	Average temperature °F Min.	Average temperature °F Max.	Soil type
8	Ga.	4/3	G. B.	5.6	Optimum	Irrigation	39	94	Sandy loam
14	Md.	3/4	G. B.	-	Optimum	Irrigation	47	81	Loam
17	Mass.	4/20	Field	6.0	Optimum	2.16	37	63	Merrimac gravelly sandy loam
25	N. Y.	5/10	Field	6.1	Optimum	0.50	56	74	Black sandy loam
30A	Okla.	3/9	G. B.	7.1	Wet	Irrigation	65	71	Loam
30B	Okla.	3/14	Field	6.1	Dry	2.08	37	61	Loam
34	S. C.	3/3	Field	5.1	Optimum	4.83	43	67	Sandy loam
35	S. C.	3/27	Field	5.7	Wet	1.55	44	63	Portsmouth sandy loam
38	Va.	2/24	Field	5.8	Optimum	4.42	35	53	Loamy sand
40	Wash.	3/21	G. B.	5.6	Optimum	Irrigation	50	70	Palouse loam and clay

[a] G. B. = greenhouse bench or flat

Table 10. Summary of lettuce tests analysed separately as randomized block experiments.

Cooperator no.	Locale	Mean percentage seedlings emerged: Red copper oxide 2%	Zinc oxide 2%	Semesan 2%	Arasan 2%	Spergon 2%	Check	Error variance (vi)	Log Vi
40	Wash.*	86.2	82.8	81.8	84.6	89.0	70.0	21.6	1.3345
35	S. C.*	65.0	52.0	58.0	57.4	54.6	49.6	27.1	1.4330
25	N. Y.*	79.8	71.8	72.2	64.8	78.0	65.4	35.3	1.5478
30B	Okla.	14.2	23.6	12.4	18.2	17.6	12.4	47.9	1.6803
14	Md.	83.2	78.0	78.8	77.2	83.6	72.4	78.6	1.8954
38	Va.	89.6	90.0	80.2	84.8	88.0	82.8	84.7	1.9279
34	S. C.	61.4	71.8	68.6	73.4	71.6	58.2	93.7	1.9717
8	Ga.	70.8	78.2	67.6	67.4	82.4	74.0	111.8	2.0483
17	Mass.*	65.6	62.2	48.0	56.6	74.6	42.0	128.4	2.1086
30A	Okla.*	61.8	40.8	53.8	69.6	55.8	21.0	296.2	2.4716
Totals	-	-	-	-	-	-	-	925.3	18.4191

*Significant difference between treatments

Table 11. Averages for data (given in Table 2) separated into 2 homogeneous groups.

Group	Number of locations	Red copper oxide 2%	Zinc oxide 2%	Semesan 0.2%	Arasan 2%	Spergon 2%	Check	Average error variance	Least difference for significance
1	4	61.3	57.5	56.1	58.7	59.8	49.3	32.9	3.5
2	4	76.2	79.5	73.8	75.7	81.4	71.8	92.8	6.0
Test 17	1	65.6	62.2	48.0	56.6	74.6	42.0	-	14.8
Test 30A	1	61.8	40.8	53.8	69.6	55.8	21.0	-	22.7

Post-emergence Damping-off

Two cooperators reported the presence of post-emergence damping-off. However, no significance could be attached to the data, less seedlings dying in check rows than in rows from treated seed.

Summary

Seed treatment seems to be a worthwhile procedure for lettuce. Spergon (2%) treated seed shows the most consistent benefits over untreated seed of the treatments tried in 1944.

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VI. ONION SEED TREATMENTS

A. G. Newhall

Damping-Off Control

Eleven tests for damping-off control and two for smut control were conducted by cooperators in 11 States. Yellow Globe onion seed was treated for the damping-off control tests by shaking in a flask with the following fungicides, each at two dosage rates as indicated (weight basis): Arasan 1 and .5%; Fermate 1 and .5%; Red Copper Oxide 1 and .5%; Spergon 1 and .5%; Semesan .5 and .3%; and Vasco 4, 3 and 1%. The cooperators counted out and sowed 100 seeds for each of 6 replications for each treatment and check. Some tests were made outdoors and some in greenhouses, as indicated in Table 12. In Ohio sufficient seed was treated to permit its being sown with a drill, in which case yield records rather than stand counts were obtained. In all other cases seedling stands were recorded 2 to 6 weeks after sowing. A summary of these counts is given in Table 13 as testimony to the value of the treatments. The relative values of the treatments are given in Tables 14 and 15. In 5 out of the 11 tests significant differences were obtained, 2 of these being greenhouse trials. The 6 failures to obtain significant differences might have been due to lack of inoculum or in some cases to unfavorable soil temperatures (California, Idaho).

From a study of the combined data from 4 tests showing significant differences (Table 13) it appears (a) that for damping-off control both levels of Arasan, Fermate, and Semesan were better than the checks and the other treatments, (b) that there was no difference between these three, and (c) that treatments with Spergon, Red Copper Oxide, and Vasco 4 were not significantly better than the checks. In one greenhouse test (Maryland) the higher dosage levels may have given slightly better results than the lower, but in the dry sandy soil of Long Island the opposite was very definitely true, so that on the whole there seems little reason for recommending the higher dosages until further evidence is secured.

Costs as computed by Gordon for treating 100 pounds of seed are said to be: Arasan at .5% - 64 cents; Semesan at .3% - 68 cents; Fermate at .5% - 35 cents. The black color of Fermate is believed by some to be handicap enough to offset its lower price. The effectiveness, favorable color, and safety of Arasan compel the writer to make it his first choice where the danger from damping-off is great enough to warrant a seed treatment for onions. Data in Table 16 seem to emphasize the value of this choice where part of the benefits from smut control may be due to damping-off control.

Table 12. Location, time, and environmental conditions of onion damping-off control tests 1944.

Coop. No.	Locality	Significance of data*	Date Sown	Date taken	Place	Soil	pH	Average air temperature	Moisture	Days to emerge
25	N. Y.	S	5/5	5/21	Field	Dry sand	5.8	65°	1.5 in.	12
33.1	R. I.	S	4/24	5/10	G'hs	Rich loam	-	-	Wet daily	-
14	Md.	S	5/15	5/24	G'hs	Sandy loam	5.6	75°	Optimum	10
27	N. Car.	S	4/7	5/2	Field	Sandy loam	5.6	-	Wet	-
29	Ohio	S	-	-	Field	Muck	-	-	-	-
17	Mass.	NS	4/28	6/5	Field	Gravelly sandy loam	6.05	58°	0.33	-
2	Calif.	NS	9/4	9/19	Field	Fine sandy loam	6.08	75°	Irrig.	-
3	Conn.	NS	-	-	-	-	-	-	-	-
10A	Idaho M.	NS	5/3	6/6	Field	Silt loam	6.9	48°	Too wet	22
10B	Idaho C.	NS	5/20	-	Field	Clay	alk.	cool	Too wet	22
35	S. Car.	NS	3/27	4/21	Field	Sandy loam	5.72	51°	Too moist	12

* S - Significant
NS - Non-significant

Table 13. Damping-off control: effect of various seed treatments on stand of onion seedlings (10 tests) and on yield (1 test)

Material and dosage	Mean Stands for 4 Significant Tests				Mean Stands for 6 Non-Significant Tests						Mean bu. per acre from one test
	Coop. #25 N. Y.	Coop. #33.1 R. I.	Coop. #14 Md.	Coop. #27 N. C.	Coop. #2 Calif.	Coop. #17 Mass.	Coop. #3 Conn.	Coop. #10A Idaho	Coop. #10B Idaho	Coop. #35 S. C.	Coop. #29 Ohio
Check	54.6	57.3	70.3	17.5	49.2	72.7	36.2	53.2	31.17	78.5	630
Arasan 1%	51.6	84.0	77.2	19.3	49.8	79.2	36.4	52.0	35.7	79.0	727
0.5%	60.8	80.1	74.1	24.2		76.3	35.6	49.7	28.2	80.1	704
Fermate 1%	59.0	80.7	72.5	24.3	48.8	78.2	41.6	50.3	29.8	79.5	496
0.5%	63.5	82.7	71.8	15.2		77.8	31.6	48.8	33.8	78.0	504
Spergon 1%	30.5	69.2	59.2	26.5	40.8	76.2	36.0	54.2	38.7	79.0	770
0.5%	36.0	61.7	62.6	21.2		76.3	34.4	50.7	34.8	78.1	726
Red copper oxide											
1%	40.0	61.2	60.3	32.8	44.8	76.0	13.4	54.3	33.7	76.5	718
0.5%	50.0	70.5	66.5	18.3		74.5	17.4	52.3	35.5	79.6	721
Semesan 0.5%	52.6	74.2	79.5	23.7	42.2	81.8	24.8	51.3	36.8	78.6	762
0.3%	59.8	72.2	74.5	24.8		72.7	36.2	55.2	41.2	77.6	727
Vasco 4, 3%	46.0	63.7	74.5	23.2	54.8	76.2	26.6	43.8	37.0	77.8	710
1%	59.3	67.8	65.7	20.5		75.2	19.8	52.5	36.7	78.5	685
F value	9.6	6.74	2.72	2.31	.827	1.1	2.10	.70	.80	.56	-
Least significant difference 5%	8.63	5.80	10.87	8.44							73
1%	11.55	13.14	14.29	11.23							
Error variance	67.00	73.27	92.42	53.52		33.183	181.686	36.894	95.793	10.000	

Table 14. Onion damping-off control: number of times each treatment significantly exceeded others in the 4 tests which showed significant differences.

Arasan		Fermate		Semesan		Red Copper Oxide		Vasco 4		Spergon		Check
.5%	1.%	.5%	1.%	.3%	.5%	.5%	1.%	1.%	3.%	.5%	1.%	
23	19	21	15	14	14	7	11	8	6	0	6	4

Maximum possible = 43

Table 15. Onion damping-off control: number of times each treatment exceeded others in the 5 comparable tests which nevertheless showed no significant differences.

Arasan		Semesan		Spergon		Fermate		Vasco 4		Red Copper Oxide		Check
.5%	1.%	.3%	.5%	.5%	1.%	.5%	1.%	1.%	3.%	.5%	1.%	
30	43	33	35	18	44	18	35	18	28	20	21	25
73		68		62		53		46		41		

Maximum possible = 60 for any single treatment level, 120 for a pair.

Table 16. Onion smut control treatments: effect of seed treatments and standard liquid formaldehyde row treatment on mean number of smutted seedlings (tests 31 and 16a) and on mean stand of seedlings (test 16b).

Coop. no.	Locality	Treatment: Check	Arasan 100%	Arasan 75%	Fermate 100%	Fermate 75%	Thiosan 100%	Thiosan 75%	Formaldehyde 1/100 at 15 cc per foot	F value	L S Difference 5%	L S Difference 1%
31	Oreg*	62.3	14.3	15.3	21.2	16.7	23.2	21.3	10.5	39.+	7.6	10.2
16A	Mass.	54.8	2.4	4.4	6.6	7.2	5.2	7.2	0.6	27.+	6.7	9.1
16B	Mass.**	224	318	305	264	280	245	255	188	10.81	37.0	41.0

* Data given as percentage of total emerged.
** Partly damping-off control.

Smut Control

Yellow Globe seed was moistened with a 5% "methocel" sticker solution and then shaken together with the fungicide in an electric paint can shaker for 5 minutes or until each seed was thoroughly coated. The fungicides and treatment levels on a weight basis were as follows: Arasan 100% and 75%, Fermate 100% and 75%, and Thiosan 100% and 75%. In addition to these treatments and the check, the cooperators employed the standard formaldehyde drip (1% commercial formalin solution at 15cc per foot of row) at the time of sowing the 6 replicates.

Data were obtained from 2 of the 4 cooperators. In Oregon the test was made with 6 100-seed replicates in a greenhouse bench, while in Massachusetts it was outdoors in clay soil with 520 seeds in each of 5 replicates. In both tests (see Table 16) all treatments were infinitely better than no treatment. Formaldehyde was the best, though its superiority does not meet the 5% level of significance, except in the greenhouse test where it was much better than Thiosan and one of the Fermates. In both tests the higher rate of application gave better control than the lower, although the difference was not always a significant one. The price of Fermate has been in its favor but its color is much against its adoption by muckland onion growers. Incidentally, over two tons of onion seed were treated with Thiosan 100% in New York State in 1944 and the outlook is for 5 times as much in 1945.

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VII. PEA SEED TREATMENTS

W. T. Schroeder

Enough pea seed of the variety Thomas Laxton was treated to provide 5 replications of 100 seeds from each treatment for 76 tests by cooperators in 26 States and in one Province in Canada. The seed was furnished gratis by Crites-Moscow Growers, Inc. The following treatments were made in a rotary seed treater: Red Cuprocide at 0.251% (2 1/4 oz. per bu.), Arasan and Spergon at 0.167% (1 1/2 oz. per bu.), and Arasan and Spergon at 0.223% (2 oz. per bu.), by weight. Samples of each treated lot were submitted to the seed laboratory of the New Jersey Agricultural Experiment Station for germination tests and the results are as follows: Check - 98.0 percent; Red Cuprocide (0.251%) - 98.0 percent; Arasan (0.167%) - 98.5 percent; Arasan (0.223%) - 98.5 percent; Spergon (0.167%) - 98.0 percent; Spergon (0.223%) - 98.0 percent. All tests, except No. 30, were conducted under field conditions.

Shortages of time and labor resulted in the collection of total emergence data from only 53 tests in 23 States and "strong plants" data from 37 tests in 15 States. All data were analyzed as individual randomized block tests and as combined tests based upon the homogeneity of error variances (method of E. B. Roessler and L. D. Leach). The locations; planting dates; soil type and reaction; moisture condition of seed bed; precipitation; minimum, maximum, and mean air temperatures from planting to average date of emergence; and average number of days to emerge are set forth in Table 17.

Total Emergence

Total emergence varied widely in the different locations, ranging from 8.2 percent, to 96.4 percent in the checks. Significant differences in emergence occurred in 32 (61 percent) of the 53 individual tests, as indicated in Table 18. On the basis of all tests, the average emergence of all treatments was 81 percent compared to 63 percent for the checks.

The emergence data from the four group analyses are given in Table 19. All treatments are significantly better than the checks in Groups I, II, and III; no significant differences occurred in Group IV. The number of individual tests in the 3 significant groups represents 94 percent of the total number of tests. In Group I, Spergon at 0.223% is better than Arasan at 0.167%. In Group II, Spergon at 0.223% is better than Red Cuprocide at 0.251% and Arasan at 0.167% and 0.223%; Spergon at 0.167% is better than Red Cuprocide at 0.251% and Arasan at 0.167%; Arasan at 0.223% is better than Red Cuprocide. In Group III,

Table 17. Planting data relative to the 1944 pea seed treatment tests.

Test no.	Location	Planting date	Soil type	Soil pH	Moist. cond. seed bed	Precipitation	Air temperature Min. °F	Air temperature Max. °F	Air temperature Mean °F	Days to Emerge
2A	Calif.	4/15	Fine sand loam	7.20	Wet	0.00	44	73	59	11
2B	Calif.	4/28	Fine sand loam	7.20	Optimum	1.19	51	79	65	10
4	Del.	4/15	Silt loam	?	Optimum	4.64	40	62	51	16
7A	Fla.	3/17	Muck	6.00	Dry	0.08	62	87	75	7
7B	Fla.	3/30	Muck	6.00	Optimum	2.08	57	80	69	6
10A	Idaho	4/5	Silt loam	6.90	Optimum	2.78	36	53	45	23
10B	Idaho	4/28	Silt loam	6.90	Wet	--	-	-	-	-
13A	Iowa	4/17	--------	7.00	--	--	-	-	-	-
13B	Iowa	4/28	--------	7.00	Optimum	--	-	-	-	-
14A	Md.	3/15	Loam	6.30	Optimum	2.23	35	55	45	23
14B	Md.	3/28	Loam	5.50	Wet	2.42	39	61	50	19
17A	Mass.	4/18	Gravelly sand loam	6.00	Wet	1.96	32	59	46	15
17B	Mass.	4/28	Gravelly sand loam	6.00	Optimum	0.00	41	73	57	10
19A	Mich.	4/29	--------	7.20	Optimum	1.15	44	63	54	9
19B	Mich.	5/8	--------	7.20	Optimum	1.97	50	70	60	9
20A	Minn.	5/15	Silt loam	5.50	Optimum	0.85	54	71	63	8
20B	Minn.	5/20	Silt loam	5.30	Wet	0.29	57	75	66	6
23A	N. J.	4/11	Loam	6.00	Optimum	3.94	39	59	49	14
23B	N. J.	4/19	Loam	6.30	Optimum	3.22	42	64	53	12
24A	N. Y.	4/29	Silt loam	7.02	Dry	2.53	49	76	63	11
24B	N. Y.	5/4	Silt loam	7.56	Wet	2.72	51	76	64	10
24C	N. Y.	5/12	Silt loam	7.07	Optimum	0.37	-	-	-	9
24D	N. Y.	5/15	Silt loam	7.82	Optimum	0.76	-	-	-	9
27A	N. C.	4/6	Sand loam	5.61	Wet	--	-	-	-	-
27B	N. C.	4/12	Sand loam	5.61	Optimum	--	-	-	-	-

29A	Ohio	4/26	Muck	5.80	Optimum	--	-	-	-	-
29B	Ohio	4/22	Silt loam	6.50	Wet	--	-	-	-	-
30A	Okla.	3/26	Sand clay loam	7.14	Wet	Watered	65	71	68	5
30B	Okla.	3/9	Loam	6.17	Optimum	1.88	39	61	50	15
30C	Okla.	3/14	Loam	6.17	Dry	2.08	36	61	49	18
30D	Okla.	3/24	Fine sand loam	5.14	Optimum	--	-	-	-	-
32A	Pa.	4/19	Clay loam	7.00	Optimum	2.60	40	60	50	11
32B	Pa.	4/30	Clay loam	7.00	Optimum	3.72	52	77	65	7
35A	S. C.	3/27	Sand loam	5.72	Wet	1.48	43	61	52	10
35B	S. C.	4/3	Sand loam	5.72	Optimum	0.04	46	69	58	8
36A	S. D.	5/24	Loam	6.50	Wet	0.26	56	81	69	6
36B	S. D.	5/29	Loam	6.50	Wet	--	-	-	-	-
38A	Va.	2/17	Sand loam	5.90	Wet	11.88	40	60	50	53?
38B	Va.	2/17	Sand loam	5.90	Wet	11.88	40	60	50	53?
38C	Va.	2/14	Sand loam	5.35	Very wet	12.31	40	61	51	61?
38D	Va.	3/25	Sand loam	5.35	Very wet	3.64	47	71	59	32
38E	Va.	9/13	Sand loam	5.80	Optimum	5.71	68	82	75	10
40A	Wash.	5/17	Loam	7.20	Dry	0.57	-	-	-	-
40B	Wash.	5/17	Loam	7.20	Dry	0.57	-	-	-	-
41	W. Va.	5/23	Clay loam	6.75	Optimum	0.30	60	90	75	9
42A	Wis.	5/24	Silt loam	6.20	Optimum	0.50	-	-	-	8
42B	Wis.	6/3	Silt loam	6.20	Dry	0.50	-	-	-	9
43A	Wis.	5/2	Silt loam	6.40	Optimum	0.91	50	65	58	10
43B	Wis.	5/16	Silt loam	6.40	Optimum	1.22	58	75	67	9
44A	Wyo.	5/1	Sand clay loam	7.50	Optimum	0.16	34	60	47	18
44B	Wyo.	5/19	Sand clay loam	7.50	Optimum	1.02	39	63	51	16
45A	Canada	5/23	Sand loam	5.20	Dry	0.05	55	82	69	6
45B	Canada	5/29	Sand loam	5.20	Dry	0.91	54	78	66	8

Table 18. Summary of individual tests with Thomas Laxton pea on total emergence, analyzed as randomized block tests (arranged according to the four groups of the combined analyses).

Test No.	Location	Average emergence from seed treated with: Check	Red Cuprocide 0.25%	Arasan 0.167%	Arasan 0.223%	Spergon 0.167%	Spergon 0.223%	Calculated F value	MSD (19:1)
13A	Iowa	89.4	97.4	95.8	95.2	96.2	97.2	4.25	4.33
13B	Iowa	94.4	92.2	95.8	96.8	95.4	96.8	1.98	N.S.
14A	Maryland	93.4	96.8	98.0	98.0	97.4	97.0	4.66	2.35
17A	Mass.	93.0	94.0	95.8	95.8	95.8	97.6	2.93	2.78
23A	N. J.	89.8	93.6	89.8	90.4	91.0	91.0	1.62	N.S.
23B	N. J.	93.6	95.4	94.0	96.8	96.2	96.2	2.28	N.S.
24D	N. Y.	96.4	98.0	93.6	96.8	94.8	95.8	2.44	N.S.
29A	Ohio	87.2	94.4	91.0	92.2	96.2	92.4	4.50	4.0
32A	Pa.	83.4	93.6	94.2	94.8	96.0	96.4	15.70	3.6
32B	Pa.	94.8	96.6	95.4	96.8	95.2	95.6	0.73	N.S.
44B	Wyo.	96.0	93.6	96.2	95.2	95.6	97.2	0.69	N.S.
45A	Canada	95.0	95.2	98.0	96.2	95.2	96.4	0.69	N.S.
10A	Idaho	87.0	93.2	94.0	92.4	97.2	95.0	3.29	10.12
14B	Maryland	55.8	90.2	86.4	90.6	91.6	96.0	57.07	5.73
17B	Mass.	82.6	86.4	85.2	74.8	85.4	77.8	5.07	6.69
19A	Michigan	72.4	93.8	93.4	95.4	95.0	95.4	2.97	4.52
20A	Minn.	74.2	91.2	89.0	90.0	92.2	91.6	15.96	5.10
20B	Minn.	67.4	86.4	80.0	79.8	82.8	86.0	6.48	8.10
24A	N. Y.	84.0	89.2	91.0	94.0	89.4	93.2	4.38	5.06
24B	N. Y.	61.6	78.0	86.2	88.8	84.6	86.8	16.20	7.48
24C	N. Y.	90.0	90.6	95.0	94.6	92.6	95.2	1.36	N.S.
29B	Ohio	80.4	92.8	88.0	92.4	93.6	95.2	11.40	4.80
30B	Okla.	88.6	96.2	96.6	97.0	95.4	95.4	3.45	4.98
30C	Okla.	81.6	91.8	95.4	93.0	94.2	96.0	11.78	4.57
30D	Okla.	57.4	89.0	88.6	94.0	92.2	92.6	51.09	5.77
35A	S. C.	72.0	82.0	82.2	87.8	90.2	91.2	9.65	6.79

35B	:S. C.	: 82.0	85.4	90.0	86.2	87.4	91.8 :	4.31	: 4.94
36A	:S. Dak.	: 80.0	87.2	85.4	85.8	87.4	83.4 :	1.58	: N.S.
36B	:S. Dak.	: 57.0	85.8	76.0	79.8	82.8	89.0 :	17.97	: 3.81
38A	:Va.	: 47.6	92.2	91.8	96.4	94.2	93.0 :	104.70	: 5.40
38B	:Va.	: 81.2	94.2	93.2	94.4	95.8	96.0 :	8.30	: 5.60
40A	:Wash.	: 78.0	79.0	81.8	81.8	85.0	87.0 :	1.41	: N.S.
41	:W. Va.	: 83.6	88.4	90.8	89.0	90.8	91.8 :	2.80	: 5.21
42B	:Wis.	: 74.2	85.2	85.4	89.2	86.0	88.0 :	5.79	: 3.13
43A	:Wis.	: 30.8	75.6	77.6	83.4	82.8	82.8 :	7.93	: 6.88
43B	:Wis.	: 27.4	70.4	74.6	78.2	72.2	79.0 :	153.00	: 4.69
44A	:Wyo.	: 88.6	92.0	92.2	92.8	92.6	94.8 :	1.29	: N.S.
45B	:Canada	: 93.8	89.8	97.2	94.2	98.2	97.6 :	2.09	: N.S.
2A	:Calif.	: 20.0	48.5	30.3	52.5	47.5	52.0 :	8.34	: 11.28
4	:Del.	: 36.4	70.0	74.0	80.4	79.4	87.4 :	34.80	: 9.10
10B	:Idaho	: 60.8	63.6	63.4	63.4	59.2	62.6 :	1.44	: N.S.
19B	:Mich.	: 19.4	66.0	50.8	63.6	68.4	72.8 :	24.50	: 4.61
27A	:N.C.	: 23.2	39.0	28.6	27.8	28.6	34.2 :	2.28	: N.S.
27B	:N.C.	: 12.0	49.8	36.4	40.6	54.2	64.2 :	23.46	: 10.99
30A	:Okla.	: 14.8	71.6	83.4	92.0	87.4	85.4 :	36.22	: 14.23
38C	:Va.	: 82.6	87.4	90.8	93.2	92.6	88.0 :	1.60	: N.S.
38D	:Va.	: 82.6	86.4	89.6	89.6	89.2	92.4 :	0.50	: N.S.
38E	:Va.	: 8.2	60.8	49.6	60.8	60.1	75.0 :	28.60	: 12.70
40B	:Wash.	: 70.6	78.4	80.6	85.8	79.0	84.4 :	2.56	: N.S.
42A	:Wis.	: 91.0	85.2	88.8	88.8	85.8	87.6 :	0.37	: N.S.
2B	:Calif.	: 34.2	42.2	43.6	50.0	56.4	52.0 :	1.60	: N.S.
7A	:Fla.	: 61.0	72.6	66.2	79.4	49.8	68.4 :	2.20	: N.S.
7B	:Fla.	: 60.8	73.2	55.4	70.8	75.4	83.4 :	1.14	: N.S.
	Average	: 62.91	79.66	78.58	81.27	81.09	83.15		

Table 19. Summary of group analyses of total emergence tests with Thomas Laxton pea - 1944.

Group	No. tests	Average emergence from seed treated with: Check	Red Cuprocide .251%	Arasan .167%	Arasan .223%	Spergon .167%	Spergon .223%	Average error variance	F value	MSD (19:1)
I	10[a]	92.26	95.12	94.60	95.30	95.34	95.56	6.770	15.16	0.93
II	26[b]	72.28	87.54	87.96	89.07	89.68	90.83	21.230	294.46	1.43
III	12[c]	44.22	67.23	63.86	69.88	69.28	73.83	76.243	87.78	0.99
IV	3[d]	52.00	62.67	55.07	66.73	60.53	67.93	294.980	2.37	N.S.

[a] Test nos. 13A, 13B, 14A, 17A, 23A, 23B, 24D, 29A, 32A, 32B, 44B, 45A.

[b] Test nos. 10A, 14B, 17B, 19A, 20A, 20B, 24A, 24B, 24C, 29B, 30B, 30C, 30D, 35A, 35B, 36A, 36B, 38A, 38B, 40A, 41, 42B, 43A, 43B, 44A, 45B.

[c] Test nos. 2A, 4, 10B, 19B, 27A, 27B, 30A, 38C, 38D, 38E, 40B, 42A,

[d] Test nos. 2B, 7A, 7B.

Table 20. Summary of individual tests with Thomas Laxton peas on number of "strong plants," analyzed as randomized block tests (arranged according to the 3 groups of the combined analyses).

Test No.	Location	Average number of "strong plants" from seed treated with						F Value	MSD (19:1)
		Check	Red Cuprocide	Arasan		Spergon			
			0.25%	0.167%	0.223%	0.167%	0.223%		
14A	Md.	89.6	92.6	94.0	94.2	92.8	92.8	1.47	N.S.
17A	Mass.	90.4	92.8	95.2	95.0	94.6	96.6	4.23	3.14
20A	Minn.	69.2	90.2	87.2	88.0	91.6	90.4	21.58	5.36
23A	N. J.	87.6	91.6	87.2	88.2	89.2	88.0	1.13	N.S.
23B	N. J.	90.6	91.2	90.8	94.0	93.4	93.4	1.96	N.S.
24D	N. Y.	89.0	91.0	85.4	90.2	86.6	88.8	1.76	N.S.
30D	Okla.	37.2	85.0	82.8	89.0	87.2	88.0	138.17	5.07
35B	S. C.	80.2	81.8	89.0	85.4	86.8	91.8	5.67	5.39
36A	S. D.	74.2	81.8	79.8	80.0	82.6	78.0	2.54	N.S.
38A	Va.	30.0	79.0	85.2	92.0	87.6	89.8	152.80	5.40
44B	Wyo.	94.8	92.8	95.0	95.2	94.0	96.2	0.52	N.S.
45A	Canada	91.8	91.2	95.2	93.6	92.8	93.4	0.54	N.S.
10B	Idaho	49.4	50.6	53.4	48.8	51.2	55.4	0.04	N.S.
14B	Md.	47.8	85.6	79.4	85.2	87.6	91.4	44.45	7.08
17B	Mass.	81.4	85.2	82.8	73.0	84.2	75.6	3.12	8.24
20B	Minn.	65.2	84.2	77.8	76.0	80.8	84.2	5.37	9.05
24A	N. Y.	70.4	79.0	77.8	87.0	77.0	83.2	3.66	8.79
24B	N. Y.	42.2	67.4	69.0	73.2	63.8	69.8	18.70	7.69
24C	N. Y.	83.0	84.8	88.2	88.8	86.6	89.4	0.80	N.S.
27A	N. C.	7.4	27.2	10.4	14.4	14.8	16.8	5.26	6.45
30B	Okla.	78.4	91.8	90.0	91.4	88.6	89.0	5.06	6.51
30C	Okla.	72.0	89.0	89.6	89.2	90.8	92.8	13.01	6.21
35A	S. C.	67.6	76.0	80.4	87.0	88.6	89.6	13.10	7.03
36B	S. D.	47.8	81.8	67.8	75.4	77.4	82.8	28.73	7.19
38B	Va.	71.6	91.6	90.8	91.0	93.8	95.0	12.70	7.00
38C	Va.	75.4	80.8	82.4	89.0	88.4	82.4	1.60	N.S.
38E	Va.	6.8	57.4	42.8	55.8	57.4	71.0	35.30	11.00
41	W. Va.	74.4	77.6	85.4	84.2	84.8	83.0	2.89	7.78
42A	Wis.	76.8	67.6	80.6	77.6	72.0	74.4	1.95	N.S.
42B	Wis.	62.2	71.4	66.8	72.8	71.2	74.0	3.14	2.34
44A	Wyo.	85.0	88.8	88.0	89.4	90.2	93.2	0.84	N.S.
45B	Canada	76.4	73.0	87.8	82.6	88.0	89.6	6.55	12.30
27B	N. C.	8.8	43.2	30.8	31.8	46.8	56.0	3.72	25.16
30A	Okla.	3.0	56.6	39.8	59.6	41.0	56.2	13.14	17.26
38D	Va.	68.8	76.4	82.0	80.8	80.0	84.2	0.70	N.S.
43A	Wis.	24.8	59.2	69.6	77.6	62.0	76.4	7.14	21.48
43B	Wis.	20.8	66.8	68.8	72.0	62.6	70.2	6.90	2.17

Table 21. Summary of group analyses of "strong plants" tests with Thomas Laxton pea - 1944.

Group	No. tests	Average number of "strong plants" from seed treated with						Average error variance	F value	MSD (19:1)
		Check	Red Cuprocide .251%	Arasan .167%	Arasan .223%	Spergon .167%	Spergon .223%			
I	12[a]	77.05	88.42	88.90	90.40	89.93	90.60	13.27	122.90	1.30
II	20[b]	62.06	75.54	74.56	76.59	76.86	79.13	42.92	86.84	5.74
III	5[c]	25.24	60.44	58.20	64.36	58.48	68.60	225.84	26.69	8.33

[a] Test nos. 14A, 17A, 20A, 23A, 23B, 24C, 30C, 35B, 36A, 38A, 44B, 45A.

[b] Test nos. 10B, 14B, 17B, 20B, 24A, 24B, 24C, 27A, 30B, 30C, 35A, 36B, 38B, 38C, 38E, 41, 42A, 42B, 44A, 45B.

[c] Test nos. 27B, 30A, 38D, 43A, 43B.

Table 22. Relative scores for pea seed treatment, represented as the percentage of the maximum number of times any one treatment could be better than all other treatments.

Treatment	Total emergence					"Strong plants"				
	Individual analyses		Group analyses			Individual analyses		Group analyses		
	Number	Score (%)[a]	Number	Score (%)[b]	Average score	Number	Score (%)[c]	Number	Score (%)[d]	Average score
Check	1	0.6	0	0.0	0.3	1	0.8	0	0.0	0.4
Red Cuprocide (0.251%)	35	21.9	4	26.7	24.3	27	22.5	3	20.0	21.3
Arasan (0.167%)	31	19.4	3	20.0	19.7	25	20.8	3	20.0	20.4
Arasan (0.223%)	41	25.6	6	40.0	32.8	33	27.5	5	33.3	30.4
Spergon (0.167%)	45	28.1	7	46.7	37.4	31	25.8	4	26.7	26.3
Spergon (0.223%)	59	36.9	11	73.3	55.1	44	36.7	7	46.7	41.7

[a] Maximum equals 160.
[b] Maximum equals 15.
[c] Maximum equals 120.
[d] Maximum equals 15.

all treatments are better than Arasan at 0.167%; Arasan at 0.223% and Spergon at both 0.167% and 0.223% are better than Red Cuprocide; and Spergon at 0.223% is also better than Spergon at 0.167% and Arasan at 0.223%.

The relative values of the various treatments are best summarized by the number of times that they are reported significantly better than some other treatment or the check. Such data converted to a score representing the percentage of the maximum number of times any one treatment could be better than all other treatments is given in Table 22. The scores obtained from both analyses are of the same order and indicate Spergon at 0.223% to be superior, followed in order by Spergon at 0.167%, Arasan at 0.223%, Red Cuprocide, and Arasan at 0.167%. The superiority of Spergon at 0.223% is further demonstrated by the fact that it was scored upon by some other treatment only 3 times out of a possible 160 in the individual tests and none in the combined analyses.

The possible protective value of seed treatment against fertilizer injury is demonstrated in tests numbers 38A and 38B, conducted in Virginia. Both tests were planted simultaneously in the same soil. The seeds in test No. 38A were planted in rows in which fertilizer had been previously mixed with the soil; those in test No. 38B in rows in which no fertilizer was applied. The emergence data show a much lower stand in the fertilized checks than in the unfertilized; whereas, the stand among the various treatments is practically identical regardless of fertilizer application.

"Strong Plants"

Similar trends with respect to the effect of treatment were obtained on numbers of "strong plants." Significant differences in number of "strong plants" occurred in 24 (65 percent) of the 37 individual tests listed in Table 20.

The combined tests were analyzed in the 3 groups listed in Table 21. All treatments are significantly better than the check in all 3 groups. In Group I, Arasan (0.223%) and Spergon (0.167%) and (0.223%) are better than Red Cuprocide; Arasan and Spergon at 0.223% are better than Arasan at 0.167%. In Group II, no differences occurred among treatments. In Group III, Spergon at 0.223% is better than either Arasan or Spergon at 0.167%.

The relative values of the various treatments with respect to "strong plants" are given in Table 22. In general, they show the same trend as in total emergence, except that Arasan at 0.223% has a higher score than Spergon at 0.167%.

Summary

The 1944 data indicate that all materials are beneficial to the emergence of peas. Significant improvement in emergence was obtained in 61 percent of the individual tests. When all individual tests were analyzed in the combined tests, significant increases in emergence were obtained in groups which represented 94 percent of the total individual tests. Similar trends were obtained with the "strong plant" data. As in previous years, Spergon gave the best results. Spergon at 2 ounces per bushel, however, was better than the lower rate of 1 1/2 ounces per bushel. Arasan at 2 ounces per bushel and Spergon at 1 1/2 ounces per bushel appeared to be equally effective. Arasan at 1 1/2 ounces per bushel and Red Cuprocide at 2 1/4 ounces per bushel were inferior, but better than the untreated seed. Both Arasan and Red Cuprocide require graphite to insure a seeding rate equal to that of untreated seed.

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION, GENEVA

VIII. VEGETABLE SOYBEAN SEED TREATMENTS

R. H. Porter

Seed treatment trials with vegetable soybean seed were conducted by 18 cooperating stations in 1944 but reports from one were not received in time to be included in the statistical analysis and summary.

Of the 17 reports only 5 gave results in which significant differences occurred between percentages of germination from treated and untreated seed. The variety used was Banzei and the seed was of high quality with a germination of 98 percent in the sand test conducted by the Iowa State College Seed Laboratory.

The treatments were Arasan, Spergon, and Fermate each at the rates of .156 and .208 percent, which are equivalent to 1 1/2 and 2 ounces per bushels respectively.

All plots were planted in randomized blocks of 5 replications, each replication consisting of 7 rows, 2 feet apart, rows 8 feet long and 100 seeds per row. The ranges (replications) were end to end. Each cooperator was given a different randomization of numbers.

The data obtained from emergence counts made by each cooperator are given in Tables 23 and 24. Table 23 includes the 5 plots in which significant differences between the untreated and one or more treated lots were obtained. The data from the other 12 plots are shown in Table 24.

In addition to the analysis by plot, two over-all analyses were made, one with the data from the 5 locations given in Table 23 and a second with the data from all 17 locations. The results of these analyses are as follows:

1. Analysis by plot (Table 23).

Significant increases in emergence from the treated lots above the untreated occurred once in Florida, 3 times in New Jersey, 4 times in New York, 6 times in South Carolina and once in Virginia. In no case was any treatment significantly lower than the untreated, but there are several instances where a treatment was significantly different from others.

2. Over-all analysis of data in 5 plots (Table 23).

Taking the data as a whole in the 5 plots in which significant differences occurred the analysis gave 4.85 as the least difference for significance between the means at the 5 percent point, which indicates that the mean of the percentage emergence for each of the 6 treatments

Table 23 - Percent emergence of treated and untreated Banzei soybean seed in five locations.

Test no.	Cooperating Station	Emergence by Treatments: Check	Arasan 1 1/2 oz.	Arasan 2 oz.	Spergon 1 1/2 oz.	Spergon 2 oz.	Formate 1 1/2 oz.	Formate 2 oz.	LDS#
6	Fla.	91.4	94.0	95.8	97.0	94.6	91	88.2	5.57
23	N. J.	90.8	95.0	90.0	93.4	94.2	95.6	88.0	2.99
25	N. Y. (L.I.)	91.6	96.6	94.2	97.6	94.0	96.4	96.0	3.00
35	S. C.	39.8	53.0	62.6	53.6	58.2	64.2	65.6	8.15
38A	Va. (Hampton)	88.4	88.0	91.4	91.8	95.2	91.2	91.6	3.76
	Mean %	80.4	85.3	86.8	86.7	87.4	87.2	85.9	4.85

#LDS - Least difference for significance between treatments at 5% point.

Table 24 - Percent emergence of treated and untreated Banzei soybean seed in 12 locations in each of which no significant differences between treatments occurred.

Test no.	Cooperating Station	Check	Arasan 1 1/2 oz.	Arasan 2 oz.	Spergon 1 1/2 oz.	Spergon 2 oz.	Formate 1 1/2 oz.	Formate 2 oz.
13	Iowa	93.2	94.2	92.2	94.8	94.8	93.4	95.6
17	Mass. (Waltham)	91.6	94.4	90.8	89.8	95.2	90.6	91.0
27	N. C.	87.4	84.2	90.0	87.8	87.0	84.8	90.4
28	N. Dak.	93.2	92.8	94.4	94.2	92.4	92.6	95.8
29	Ohio	76.8	78.6	85.8	86.8	83.6	76.8	80.2
30	Okla.	88.0	94.0	91.8	92.4	94.2	92.6	93.0
32	Pa. (College)	97.0	96.8	97.0	97.0	97.0	96.6	97.6
33	Pa. (Burpee)	90.0	91.0	92.2	93.4	95.4	93.4	93.2
34	S. C.	91.4	91.2	91.2	94.6	94.6	89.6	94.2
38B	Va. (Diamond Sp)	82.6	84.6	87.0	81.2	89.2	89.2	90.0
39	Wash.	93.6	95.0	91.8	94.4	94.8	89.6	86.0
41	W. Va.	93.2	94.6	92.4	96.4	92.0	94.4	96.0
	Mean % emergence for all 17 plots	87.0	89.3	90.0	90.4	93.3	89.5	90.2

was significantly higher than that of the untreated. It must be recognized that such an analysis is based on selected data, which procedure may be questionable in that the probability may be higher. The only reason for this grouping is that the results in the other 12 plots were either extremely variable or the differences were uniformly small. In the latter case it must be assumed that the conditions for seed germination were equally favorable for the treated and untreated samples.

3. Over-all analysis of the data in 17 plots.

When the analysis was made of all the data grouped together it was found that there were significant differences between individual percentages as between locations, the least difference for significance being 10.32 at the 5 percent point. An examination of the data indicates that any significant differences are largely the result of location rather than treatment and only in the South Carolina plot are the differences between individual treatments equal to or greater than 10.32. The means of all treatments in the 17 plots are so close together that the only treatment which might possibly be considered superior to the others is Spergon (2 oz.).

The conclusion that may be drawn from the tests in 1944 using seed of Banzei soybean with an exceptionally high vitality is that seed protection was of some value in about 1/3 of the locations and not all compounds were equally effective in each of those locations. All the plots in which significant differences occurred were in states along the Atlantic seaboard. In 3 of those the soil was optimum as to moisture and in 2 it was wet at planting time. Spergon at the rate of 2 ounces per bushel gave the most consistent increases in emergence over the untreated not only in the 5 selected plots but in all the 17 plots. Given unfavorable conditions for germination in the field, one could expect seed protectants to be of value even with seed of high vitality and if seed of low vitality were used the benefit should be greater. The tests in 1945, if continued, should include a lot with less vitality than that of the 1944 lot.

IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, AMES, IOWA

IX. SPINACH SEED TREATMENTS

G. K. Parris

During 1944, the following chemical seed treatments were tried on spinach: - Arasan (0.25% and 0.50% by weight), Fermate (0.50% and 0.75%), and Zinc oxide (1.5% and 2.0%). Thirty-six sets of data from 29 cooperators located in 25 States of the United States and one Canadian Province were submitted for analysis. Nineteen cooperators reported significant differences between treatments.

The data given in Table 25 indicate the geographical location and key number of each cooperator, and the prevailing environmental conditions for each test. In Table 26 are given the 36 tests, arranged in order of their respective error variances, and the mean percent seedlings emerged per treatment. To these data have been applied an analysis designed by Roessler and Leach (footnote, page 6), which applies the Chi-square test to determine the homogeneity of data from different locations. Eighteen tests (numbers 27, 28, 29A, 38A, 8A, 29B, 35, 17, 45, 38B, 2, 20, 44, 24, 30A, 10, 38C, and 8B) with low error variances fall into homogeneous Group 1, and 15 other tests (30C, 5, 36, 1, 4, 31, 30B, 33, 23, 42, 19, 34, 43, 3, and 32) constitute a second homogeneous group (Group 2). Two tests, both with very low error variance (25 and 41) do not fit into either Group 1 or Group 2 and must be considered alone (Group 3). Outstanding is test no. 14 which has an error variance so large that it cannot be fitted into any one of the three groups.

Emergence

The least difference necessary for significance between the means of Group 1 is 1.7 seedlings (Table 27). Thus all treatments are better than the control, and zinc oxide is the best treatment. Between Arasan and Fermate there is no significant difference. Zinc at 1.5% is just as good as zinc at 2% and the same is true of different rates of Arasan and Fermate.

In Group 2, the least difference necessary for significance is 2.8 seedlings. Again all treatments are better than the check, and again zinc is the superior of Arasan and of Fermate. There was no difference between rates of application for zinc, Arasan, or Fermate.

In Group 3 the same general trends hold.

Post-emergence Damping-off

Thirteen cooperators reported post-emergence data. When analysed, 9 tests showed no significant difference between treatments. In one of

TABLE 25. Location, time, and environmental conditions of spinach seed treatment tests - 1944.

Report from Test no.	Locale	Planting date 1944	Planted in	Soil conditions pH	Soil conditions Moisture	Rainfall inches	Average temperature Min. °F.	Average temperature Max. °F.	Soil type
1	Ark.	4/5	Field	-	Optimum	4.00	45	70	Clarksville silt loam
2	Calif.	2/18	Field	6.8	Dry	2.64	37	62	Fine sandy loam
3	Conn.	5/20	G.B.*	6.2	Very wet	2.00	63	87	Sandy loam
4	Del.	4/30	Field	-	Wet	0.57	49	78	Sassafras silt loam
5	Fla.	2/18	Field	5.8	Optimum	Irrig.	53	79	Loamy sand
8A	Ga.	3/8	G.B.*	5.6	Optimum	Irrig.	50	88	Sandy loam
8B	Ga.	3/10	Field	5.7	Dry	4.70	41	69	Cecil clay
10	Idaho	4/7	Field	6.9	Dry	2.66	50	35	Palouse silt loam
14	Md.	9/21	Field	5.4	Optimum	2.05	49	67	Sandy loam
17	Mass.	4/20	Field	6.0	Optimum	2.16	37	64	Merrimac Gravelly sandy loam
19	Mich.	4/29	Field	7.2	Optimum	1.16	43	-	Sandy loam
20	Minn.	5/15	Field	5.2	Optimum	0.98	55	72	
23	N. J.	4/14	Field	5.8	Optimum	4.01	38	58	Sassafras loam
24	N. Y.	5/2	Field	7.0	Optimum	2.90	49	76	Dunkirk silty clay loam
25	N. Y.	5/10	Field	6.1	Optimum	0.67	56	74	Black sandy loam
27	N. C.	4/7	Field	5.6	Wet	5.17	51	74	Norfolk sandy loam
28	N. Dak.	4/13	Field	7.0	Optimum	1.06	34	56	Fargo clay
29A	Ohio	4/26	Field	5.8	Optimum	-	-	-	Muck
29B	Ohio	4/26	Field	6.2	Wet	-	-	-	Loam
30A	Okla.	3/7	G.B.	7.1	Wet	Irrig.	65	71	Sandy clay loam
30B	Okla.	3/9	Field	6.1	Dry	1.88	38	61	Loam
30C	Okla.	3/24	Field	5.1	Optimum	0.38	38	63	Fine sandy loam
31	Oreg.	3/15	Field	6.0	Dry	0.77	36	59	Chehalis clay loam
32	Pa.	5/15	Field	7.5	Optimum	3.21	56	78	Hagerstown clay loam

32	Pa.	5/15	Field	7.5	Optimum	3.21	50	78	Hagerstown silt loam
33	Pa.	9/27	Field	-	Optimum	-	-	-	
34	S. C.	3/2	Field	5.1	Optimum	5.01	41	66	Sandy loam
35	S. C.	3/27	Field	5.7	Wet	1.48	43	62	Portsmouth sandy loam
36	S. Dak.	5/22	Field	6.5	Wet	0.03	53	81	Barnes loam
38A	Va.	2/23	G.B.*	5.8	Optimum	Irrig.	61	85	Sandy loam
38B	Va.	4/11	Field	6.2	Optimum	2.37	50	72	Sandy loam
38C	Va.	4/21	Field	6.2	Optimum	0.80	53	77	Sandy loam
41	W. Va.	2/21	G.B.*	-	Optimum	Irrig.	-	-	Loam
42	Wis.	5/24	Field	6.2	Optimum	-	-	-	Loam
43	Wis.	5/2	Field	6.4	Optimum	1.63	53	70	Miami silt loam
44	Wyo.	5/6	Field	7.5	Dry	0.65	38	64	Sandy loam
45	Canada	4/5	G.B.*	7.4	Optimum	Irrig.	55	89	Loam

* Greenhouse bench or flat.

TABLE 26. Summary of spinach tests analysed separately as randomized block experiments.

Cooperator no.	Locale	Mean percent seedlings emerged							Error variance	Log Vi
		Arasan		Fermate		Zinc oxide				
		0.25%	0.50%	0.50%	0.75%	1.5%	2.0%	Check		
25	N. Y.*	48.4	51.2	41.6	45.0	63.2	56.4	39.2	11.7	1.0682
41	[illegible] Va.*	64.4	73.2	67.0	67.2	71.8	69.4	51.4	14.3	1.1523
27	N. C.*	10.0	12.2	15.2	4.2	11.6	8.6	3.8	22.0	1.3424
28	N. Dak.	42.0	40.6	39.4	52.5	38.6	36.6	40.2	22.2	1.3464
29A	Ohio*	57.0	65.0	60.0	54.0	63.0	59.0	43.0	24.7	1.3927
38A	Va.*	61.3	56.0	68.0	62.0	54.3	58.0	12.0	24.8	1.3945
8A	Ga.*	73.0	75.0	72.8	75.0	76.2	78.2	64.4	25.3	1.4031
29B	Ohio	10.4	15.4	10.0	15.6	20.4	17.4	15.8	25.3	1.4031
35	S. C.*	70.6	72.2	69.2	73.8	65.2	68.4	54.4	27.6	1.4409
17	Mass.*	72.6	67.8	60.6	73.4	76.2	72.8	38.4	32.2	1.5079
45	Canada*	82.0	80.6	79.2	85.6	81.8	82.4	65.0	33.9	1.5302
38B	Va.	10.6	9.0	9.3	3.6	15.0	12.6	8.6	35.4	1.5490
2	Calif.*	51.0	48.8	50.0	50.2	63.8	55.2	54.2	36.5	1.5623
20	Minn.	34.8	42.0	37.6	37.4	43.8	34.7	32.6	40.1	1.6031
44	Wyo.	48.6	47.2	41.8	50.4	46.6	50.4	47.4	42.9	1.6325
24	N. Y.	62.2	56.6	60.0	61.8	63.4	62.2	60.2	43.8	1.6415
30A	Okla.*	65.4	69.4	68.8	71.0	72.4	64.4	52.6	51.5	1.7118
10	Idaho	76.0	75.2	66.0	71.4	70.8	70.8	67.8	54.5	1.7364
38C	Va.	41.8	39.8	45.2	37.8	50.6	49.8	43.0	59.9	1.7774
8B	Ga.	57.2	49.6	52.2	50.4	58.8	62.0	50.4	64.9	1.8122
30C	Okla.	57.6	59.8	43.0	52.0	60.6	58.8	28.4	66.6	1.8235
5	Fla.	44.6	39.8	40.0	40.0	48.2	50.8	49.0	70.2	1.8463
36	S. D.*	36.2	29.2	38.2	35.4	47.2	40.0	29.0	71.1	1.8519
1	Ark.	57.8	55.6	60.0	61.8	62.0	63.8	48.4	75.0	1.8751
4	Del.*	41.2	59.0	43.8	42.6	58.2	53.6	50.0	81.0	1.9095
31	Oreg.	55.8	57.4	52.2	53.6	69.0	64.4	62.2	86.1	1.9350

30B	: Okla.	: 62.0	59.6	61.4	68.8	66.6	69,2	57.2	: 87.9	:	1.9440
33	: Pa.	: 48.6	53.4	43.4	52.4	47.2	41.0	22.2	: 96.7	:	1.9854
23	: N. J.*	: 47.4	62.6	60.0	55.8	56.2	54.0	40.2	: 96.8	:	1.9859
42	: Wis.	: 37.6	36.0	34.4	30.2	36.2	30.2	35.0	: 98.0	:	1.9912
19	: Mich.*	: 34.6	37.4	27.4	26.6	43.4	41.0	22.6	: 106.6	:	2.0278
34	: S. C.	: 37.8	32.0	28.8	28.8	39.2	42.4	35.8	: 109.9	:	2.0411
43	: Wis.*	: 39.6	34.8	33.8	36.6	32.4	41.4	7.2	: 123.6	:	2.0920
3	: Conn.	: 47.4	54.0	58.6	51.8	53.2	50.6	34.0	: 154.4	:	2.1886
32	: Pa.	: 32.2	32.6	34.8	26.0	30.8	40.8	33.8	: 187.3	:	2.2725
14	: Md.*	: 39.8	40.6	36.2	33.0	19.4	25.4	4.4	: 260.7	:	2.4161
Totals		-	-	-	-	-	-	-	2465.4		62.1938

* Significant difference between treatments.

TABLE 27. Effect of chemical seed treatments on emergence of spinach seedlings.

Group	Number locations	Average Number of Seedlings							Average error variance	Least difference required for significance
		Arasan		Fermate		Zinc oxide		Check		
		0.25%	0.50%	0.50%	0.75%	1.5%	2.0%			
1	18	51.4	51.2	50.2	51.9	54.0	52.4	42.1	37.0	1.7
2	16	42.5	43.9	41.2	41.4	46.9	46.3	34.6	82.7	2.8
3	2	56.4	62.2	54.3	56.1	67.5	62.9	45.3	13.0	3.2
Test 14	1	39.8	40.6	36.2	33.0	19.4	25.4	4.4	260.7	21.0

the 4 tests where a significant difference was found, more seedlings damped-off where treated seed was planted than in the checks, leaving only 3 treatments worthy of consideration. In all 3 tests, zinc oxide and Arasan reduced post-emergence damping-off significantly; there seemed to be no difference between rates of application. In 2 out of the 3 tests, Fermate reduced damping-off, also without difference between rates of chemical applied.

Summary

As recognized previously, and repeated in 1944, seed treatment of spinach is worthwhile. Arasan, Fermate, and zinc oxide, at all rates tried, gave significant increases over untreated checks. However, in 1944 the best treatment was zinc oxide, either at 1.5% or at 2%. Fermate (like zinc oxide) is abrasive to spinach seed, and in view of the 1943 and 1944 findings the use of this material, either commercially or in national cooperative seed treatment tests, is not to be encouraged. The failure of Arasan to measure up to zinc oxide, as found in 1943, is disappointing, for this material is not abrasive and seedsmen dislike the graphite they have to add as lubricant. Seed bags in which graphite-treated seed has been stored decay more rapidly than bags without graphite and are practically impossible to clean, and their resale value is much reduced.

Reduction in the rate of zinc oxide from 2.0% to 1.5% means a saving in cost of treatment from $0.45 to $0.60 per 100 pounds of seed to $0.34 to $0.45. It may be of interest to report that seedsmen in the Tidewater area of Virginia have actually been using zinc oxide at the 1.5% rate for years.

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X. SWEET CORN SEED TREATMENTS

B. H. Davis

A lot of sweet corn seed of the variety Ioana with a low germination test (73%) was purposely selected for the 1944 cooperative tests. Although the data from such a low vitality lot favor the use of seed protectants, it was hoped that the potentialities of the various protectants would be brought out more strongly than in the past when seed lots with high germination tests were used.

Two dosages (1.5 and 3.0 oz. per bu.) of 4 protectants, Semesan Jr., Arasan, Spergon, and Barbak C, were planted along with the nontreated in 5 replications of 100 seed each. From 32 lots of seed planted by 24 cooperators in 15 States and one Canadian Province, data were received from 30. Records of the environmental conditions prevailing at each of these locations are given in Table 28 and the mean seedling counts and the statistical significance of the data are presented in Table 29.

It is highly significant that of the 30 tests conducted 27 or 90% showed a significantly higher emergence from the treated than from the nontreated seed. This is a much higher percentage than that obtained in previous years when seed lots with high germination tests were used.

The number of tests in which seedling emergence for one treatment was significantly greater than that for each other treatment and the relative value of the several treatments follows: (Maximum score 216)

Column 1		Number of times treatment in Column 1 was better than										Score of treatments
		Semesan Jr. 1.5	Semesan Jr. 3.0	Arasan 1.5	Arasan 3.0	Spergon 1.5	Spergon 3.0	Barbak C 1.5	Barbak C 3.0	Check		
Semesan Jr.	1.5		1					5	2	7		15
Semesan Jr.	3.0	5		1		2	1	7	5	11		32
Arasan	1.5	21	22		1	13	11	23	22	25		138
Arasan	3.0	22	21	2		16	8	26	24	26		145
Spergon	1.5	11	6					18	15	21		71
Spergon	3.0	18	17			5		22	21	25		108
Barbak C	1.5	1								2		3
Barbak C	3.0	1	1					3		8		13
Check								1				1

An analysis of combined data produces a homogeneous group (footnote, page 6) if tests 34, 4 and 38A are omitted. The averages and statistical analysis for the 27 tests follows:

No. of tests	Average Number of Seedlings								Average error variance	F value	L.D.S*
	Semesan Jr.		Arasan		Spergon		Barbak C		Check		
	1.5	3.0	1.5	3.0	1.5	3.0	1.5	3.0			
27	45.9	47.4	59.7	61.4	51.2	55.3	42.0	44.2	39.9	33.28	26.8	1.4

* Least difference required for significance at 5% level.

In these 1944 tests seed treated with each of the four protectants at the dosages indicated produced a significantly greater number of seedlings than the untreated seed. Arasan was the outstanding protectant, followed by Spergon, Semesan Jr., and Barbak C, with each material significantly better than each following material. Also, in the case of each protectant the 3 oz. dosage was significantly better than the 1.5 oz. dosage.

Data on "very weak seedlings" were obtained from 19 of the 30 tests. These data were not treated statistically but the mean emergence and the percentage of the seedlings classified as "very weak" were calculated for the check and for each of the 4 protectants (both dosages combined) for the 19 tests taken as a group. These data are presented below:

Protectant	Mean emergence	Percent Weak Seedlings
Arasan	61.0	7.14
Spergon	53.7	9.61
Semesan Jr.	46.8	11.16
Barbak C	43.3	12.52
Check	39.9	12.69

It will be seen that the lowest percentage of weak seedlings and the highest mean emergence were obtained from seed treated with Arasan and that without exception the higher the mean emergence for the treatment the lower the percentage of weak seedlings. Thus the seed protectant may benefit not only by increasing the total emergence but also by decreasing the percentage of weaklings in the final stand. This same relationship held for the results obtained in 1943 when it was stated that the data "would indicate definitely that a greater benefit may be derived from treatments than are shown in the 'total emergence' used in calculations."

Table 28. Location, time and environmental conditions for Cooperative Sweet Corn Tests - 1944

Coop. No.	Locality	Planting date	Planted in*	Soil pH	Soil Moisture at planting	Soil Type	Germ. Period b Total precipitation	Germ. Period b Mean air temperature Min.	Germ. Period b Mean air temperature Max.	No. of days to emergence a
							In.	°F	°F	
12	Ind.	4/21	F	-	Wet	Sandy	2.07	47	67	-
14	Md.	2/12	G.B.	5.6	Wet	Sandy loam	*	49	77	11
38B	Va.	4/11	F	5.7	Optimum	Sandy loam	2.37	49	74	16
30A	Okla.	4/22	F	5.14	Optimum	Sandy loam	3.01	54	72	11
13	Ia.	4/17	F	Neutral	Very wet	- - -	-	-	-	-
30C	Okla.	4/25	F	5.14	Optimum	Sandy loam	1.72	49	73	11
17	Mass.	5/4	F	6.25	Optimum	Sandy loam	.33	44	75	11
5	Fla.	2/18	F	5.7	Optimum	Sandy loam	.03	58	84	6-8
38C	Va.	4/21	F	6.2	Optimum	Sandy loam	.53	53	78	15
22A	Nebr.	5/16	F	7.4	Optimum	Clay loam	.71	64	85	-
44A	Wyo.	5/6	F	7.5	Optimum	Sandy silt loam	.75	38	64	26-28
25	N. Y.	5/9	F	6.24	Optimum	Sandy loam	.57	56	72	14
32	Pa.	6/1	F	6.7	Optimum	Clay loam	2.53	55	75	-
3	Conn.	5/18	F	6.2	Optimum	Sandy loam	-	48	74	11
33	Pa.	6/22	F	-	Wet	- - - -	-	-	-	-
2C	Minn.	5/15	F	5.6	Optimum	Silt loam	1.40	56	74	11
44B	Wyo.	5/23	F	7.5	Optimum	Sandy silt loam	1.69	41	63	20
30B	Okla.	4/8	F	6.17	Optimum	Loam	3.65	50	76	14
34	S. C.	3/15	F	5.2	Optimum	Sandy loam	5.54	48	71	10
4	Del.	4/30	F	-	Opt. to wet	Silt loam	.57	50	78	-

34	S. C.	3/15	F	5.2	Optimum	Sandy loam	5.54	48-71	10
4	Del.	4/30	F	-	Opt. to wet	Silt loam	.57	50-78	-
40	Wash.	5/17	F	7.2	Very dry	Palouse loam	.08	42-62	-
22B	Nebr.	5/18	F	7.1	Optimum	Clay loam	2.53	62-85	-
35	S. C.	4/17	F	5.72	Optimum	Sandy loam	3.58	60-77	6-7
24	N. Y.	5/26	F	7.8	Optimum	Ontario loam	.81	58-84	10
29	Ohio	5/9	F	6.2	Wet	Silt loam	3.11	-	-
23	N. J.	5/5	F	5.2	Optimum	Sassafras loam	2.00	53-72	10
36	S. Dak.	5/23	-	6.5	Wet	Barnes loam	.26	55-82	-
22C	Nebr.	5/19	F	6.8	Optimum	Clay loam	1.13	64-82	-
38A	Va.	5/26	F	5.8	Dry	Sandy loam	*	65-86	8
45	Canada	5/23	F	5.18	Very dry	Sandy	1.15	52-78	8-11

NOTES:- * F-field; G.B. - greenhouse bench.

** Artificially watered.

a "Number of days to emerge" was taken as the time between planting and time when the majority of the seedlings emerged.

b When sufficient data were supplied the germination period was arbitrarily considered as 50% longer than "number of days to emerge" in order to include data on moisture and temperatures during the period of post-emergence damping-off. In some cases the environmental data were supplied only to the time when the majority of seedlings emerged.

Table 29. Effect of seed protectants on emergence of sweet corn seedlings.

Coop. No.	Locality	Seedling emergence, percent from 500 seeds									Diff. req. sign.*	Calc. "F" Value
		Semesan Jr. 1.5	Semesan Jr. 3.0	Arasan 1.5	Arasan 3.0	Spergon 1.5	Spergon 3.0	Barbak C 1.5	Barbak C 3.0	Check		
12	Ind.	15.6	15.4	48.2	65.4	32.8	36.0	13.8	18.4	8.8	8.66	39.89
14	Md.	32.2	38.4	58.0	64.2	40.8	45.2	24.2	28.2	21.0	6.84	38.81
38B	Va.	14.0	21.2	48.6	52.0	28.8	38.8	14.4	16.2	17.8	7.36	34.50
13	Ia.	9.2	16.8	34.6	42.8	23.0	31.8	6.8	8.4	5.2	7.31	29.93
30A	Okla.	36.6	32.4	60.6	65.0	42.4	51.4	31.8	41.0	30.6	7.40	24.75
30C	Okla.	37.8	33.6	57.0	60.0	47.0	48.6	33.8	39.8	30.6	6.47	22.35
17	Mass.	57.6	55.4	70.4	73.4	63.4	69.0	46.2	47.4	48.2	11.64	21.83
5	Fla.	51.4	60.8	69.0	69.6	60.2	57.8	38.6	48.4	46.0	7.07	18.31
38C	Va.	41.6	42.8	66.2	66.6	50.4	59.4	41.6	38.4	37.0	8.28	16.99
22A	Nebr.	56.6	65.2	70.4	64.8	54.8	60.0	43.6	47.2	48.4	6.33	16.96
44A	Wyo.	46.8	45.8	62.6	59.2	47.2	54.4	42.0	40.2	38.4	6.67	13.40
25	N. Y.	53.2	56.6	69.8	69.2	62.8	63.4	46.2	51.8	48.4	7.00	13.01
32	Pa.	58.0	50.6	60.2	61.2	55.0	57.6	55.2	50.2	40.0	5.82	10.56
3	Conn.	47.6	43.6	63.8	65.6	53.4	60.4	47.6	46.0	44.2	7.82	10.22
33	Pa.	53.6	50.0	61.8	61.0	50.6	55.8	44.4	46.0	36.6	8.35	7.59
20	Minn.	35.2	36.8	48.8	53.8	40.2	45.2	29.6	30.6	30.6	9.46	7.04
44B	Wyo.	48.8	53.6	65.0	59.8	57.2	59.0	50.4	47.4	37.6	9.51	6.25
30B	Okla.	53.0	53.8	64.0	64.4	57.8	62.8	47.8	47.0	48.2	8.25	6.18
34	S. C.	50.2	48.8	63.2	66.6	64.2	65.2	52.4	54.8	42.6	10.90	5.21
4	Del.	49.6	42.4	61.8	60.0	50.6	57.0	39.0	39.8	38.6	12.01	4.97

40	Wash.	49.0	41.4	55.0	57.6	51.8	51.2	43.8	46.8	40.2	7.99	4.69
22B	Nebr.	36.8	57.0	46.8	55.0	46.2	47.2	46.8	46.2	40.8	8.29	4.66
35	S. C.	60.2	60.4	63.4	67.8	62.0	66.6	56.2	60.0	57.4	5.36	4.34
24	N. Y.	49.2	48.8	55.0	54.8	52.6	54.8	46.2	46.2	45.6	5.64	4.16
29	Ohio	56.0	64.6	64.4	62.6	61.6	61.0	52.4	62.0	53.4	6.91	3.75
23	N. J.	61.0	57.8	66.2	60.6	61.8	59.6	56.4	60.0	57.0	5.37	2.53
36	S. Dak.	49.0	53.0	55.0	60.2	56.4	59.2	52.0	55.6	49.8	7.35	2.32
22C	Nebr.	61.0	54.8	60.2	51.8	58.8	65.2	55.8	58.4	54.4	N.S.	2.19
38A	Va.	64.2	62.6	62.0	68.0	60.2	62.0	59.4	56.4	57.6	N.S.	.98
45	Canada	67.8	69.2	67.2	68.4	64.0	70.4	66.8	65.2	61.0	N.S.	.87

* Mean difference required at 5% level.

Data on the mean height of plants supplied by one cooperator (Brooks, Florida) taken 34 days after planting, show that both dosages of Arasan are significantly better than all remaining treatments except Semesan Jr. at 1.5 oz. The poorest results were obtained with Barbak C. The order of the three best treatments was Arasan 3 oz., Arasan 1.5 oz., and Spergon 3 oz., which is the same order as that based on increased total emergence. The order, on the same basis, for the remaining treatments is altered somewhat, particularly with respect to dosages. However, the order for materials is again the same, namely; Arasan, Spergon, Semesan Jr., and Barbak C.

Data on uniformity of emergence were supplied from one test (No. 14, Cox, Maryland). Two counts were made, one 14 and a second 28 days after planting. The percentage of the final mean stand that had emerged at the time of the first count ranged from 95.5 to 82.3. With only one test the data are too meager to draw definite conclusions but they suggest that those treatments which give the highest mean emergence and the lowest percentage of weak seedlings also encourage prompt and uniform emergence.

From the standpoint of increased emergence, decreased percentage of weak seedlings, increased plant growth (1 test) and uniformity of emergence based on 2 counts at 14 day periods (1 test), Arasan is the outstanding material in the 1944 cooperative sweet corn tests.

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XI. TOMATO SEED TREATMENTS

S. P. Doolittle and F. S. Beecher

The 1944 trials of seed protectants included most of the treatments used in the 1943 tests and were intended to supply further evidence as to the relative value of certain of the older standard treatments and some newer compounds now being rather widely used. The single new treatment in 1944 consisted of the use of New Improved Ceresan as a dust. This treatment, introduced by B. H. Davis and C. M. Haenseler of the New Jersey Experiment Station, presents a possible substitute for the 1-1200 New Improved Ceresan dip now generally applied to seed used for tomato plant production in the South.

All of the seed (Rutgers variety) was treated at Beltsville, Maryland, and sent to the cooperators, who planted it in 5 randomized blocks each consisting of 7 treatment plots of 100 seeds each. The data were taken on the basis of total emergence and were analyzed statistically by a standard method.

Through the kindness of Mrs. Vivian K. Toole of the Bureau of Plant Industry, Soils, and Agricultural Engineering, seed samples of each treatment and the check were tested for germination according to the rules of the Association of Official Seed Analysts. The testing was done during June, 1944, and there were no significant differences, the final figures ranging from 94.0 to 96.75 percent.

The treatments used were: Spergon (0.3% by weight of seed); Arasan (0.3%); Semesan (0.3%); Yellow Cuprocide (1.5%); New Improved Ceresan dust (0.5%); a 5-minute dip in a 1-1200 solution of New Improved Ceresan; and an untreated check.

In the tomato tests, data were received for 14 trials conducted in various localities in 11 States. Eight of these trials were made in the greenhouse and 6 in the field. Two of the latter trials were abandoned because of crusting of the soil, and no emergence counts were made.

Table 30 shows the location, time of planting, environmental conditions, and average number of days required for emergence of seedlings. The data on total emergence and their statistical significance are given in Table 31.

Table 32 shows the number of tests in which seedling emergence of any single treatment was significantly greater than that for any other treatment and indicates the relative value of the various treatments in this set of tests, when compared in such a manner.

Table 30. Location, time, and environmental conditions of tomato seed treatment tests with Rutgers variety in 1944.

Report from: Test no.	State	Planting date	Soil conditions: Type	pH	Moisture	Rainfall	Air temperature: Min. - Max.	Days to emerge
						In.	°F - °F	
3	Conn.	5/20	Sandy loam	6.2	Very wet	G.H.[a]	58 - 95	7
8	Ga.	4/1	Sandy loam	5.7	Optimum	G.H.	25 - 104	18
14	Md.	4/20	Sandy loam	5.6	Wet	G.H.	38 - 96	8
15	Md.	4/10	Sandy loam	5.7	Wet	G.H.	63 - 92	12
23	N. J.	3/16	Sandy loam	6.85	Wet	G.H.	44 - 84	7
25	N. Y.	5/12	Sandy loam	6.15	Optimum	-	46 - 84	12
33	Pa.	8/9	Sandy loam	-	Dry	-	-	-
35	S. C.	3/27	Sandy loam	5.72	Wet	1.48	28 - 78	10 - 12
38A	Va.	3/16	Loamy sand	7.2	Optimum	G.H.	49 - 103	9
38B	Va.	4/21	Sandy loam	6.2	Optimum	.81	41 - 89	11
40	Wash.	3/20	Loam and peat	5.8	Optimum	G.H.	60 - 80	8
41	W.Va.	3/23	Loam	5.3	Optimum	G.H.	55 - 88	7

[a] G.H. refers to greenhouse test.

Table 31. Emergence data for cooperative tomato seed tests analyzed as randomized block tests, 1944.

Report from: Test no.	State	Average emergence from seed treated with: Spergon 0.3%	Arasan 0.3%	Semesan 0.3%	Yellow Cuprocide 1.5%	New Improved Ceresan 0.5%	New Improved Ceresan dip 1-1200	Untreated check	Least significant difference[a]	Calculated "F" Value
		%	%	%	%	%	%	%	%	
15	Md.[b]	94.6	93.2	95.8	95.6	92.2	93.6	85.4	4.33	5.69
23	N. J.	84.8	93.0	87.8	92.0	91.4	92.6	81.6	5.17	5.68
35	S. C.	74.4	83.2	82.6	76.4	79.6	74.4	69.0	6.69	4.89
40	Wash.	90.2	95.6	85.4	94.0	92.2	94.6	64.8	6.93	20.73
41	W.Va.	87.2	94.4	91.2	94.6	93.0	94.6	84.2	4.29	7.81
3	Conn.	56.8	55.8	62.4	60.2	65.4	53.6	56.8	NS	0.76
8	Ga.	86.8	87.6	89.2	88.2	90.6	90.8	87.6	NS	0.59
14	Md.	84.4	84.6	82.3	83.6	90.6	82.8	90.0	NS	2.144
25	N. Y.	80.8	83.8	81.0	82.0	83.8	81.6	81.4	NS	--
33	Pa.	53.0	53.4	51.6	56.2	44.2	51.6	54.8	NS	1.52
38A	Va.	13.8	22.4	19.2	18.6	22.0	26.8	14.0	NS	1.51
38B	Va.	84.8	81.6	84.6	79.8	88.2	83.6	82.6	NS	0.44

[a] At 5% point

[b] Soil known to be infested with Pythium spp.

Table 32. Relative value of different protectants in improving emergence from tomato seed, 1944.

	Number of times a given treatment (Column 1) was superior to							Total[a] score
	Spergon	Arasan	Semesan	Yellow Cuprocide	New Improved Ceresan (dust)	New Improved Ceresan (dip)	Untreated check	
Spergon	-	-	-	-	-	-	2	2
Arasan	3	-	1	1		1	5	11
Semesan	1	-	-			1	5	7
Yellow Cuprocide	2	-	1	-	-	-	5	8
New Improved Ceresan (dust)	2	-	-	-	-	-	5	7
New Improved Ceresan (dip)	2	-	1	-	-	-	4	7
Untreated check	-	-	-	-	-	-	-	0
		-	-	-	-	-	-	

[a] Maximum value 30

Only 5 of the 12 tests included in the above tables showed significant differences between treatments. In 2 of these, all 6 protectant treatments gave significantly better stands than the checks. Five of the 6 treatments were superior to the check in 4 of the 5 significant trials and 4 treatments were superior in all 5 trials. Arasan dust showed a definite superiority over the other treatments in the total score, but Semesan, Yellow Cuprocide, and the Ceresan treatments all gave good results. Spergon, as in 1943, seemed definitely less effective than Arasan and others as a treatment for tomato seed.

The performance of New Improved Ceresan as a dust indicates that the use of this material in dust form may eventually replace the dip method. A general inspection of the data shows no evidence of seed injury in any trial and, as a protectant, it equaled the 1-1200 dip treatment and was about as effective as any treatment other than Arasan. Seed germinated in soil did not show any pronounced retardation in seedling emergence and growth. Since the Ceresan treatments combine effective surface disinfection with a good degree of protection against pre-emergence damping-off, they possess definite value in tomato seed treatment.

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XII. SUMMARY

During 1944 a total of 236 uniform seed treatment tests were conducted by 40 cooperators located in 29 States and two Canadian provinces on 10 vegetable crops as part of a cooperative project started in 1940 under the auspices of a committee appointed by the American Phytopathological Society.

The crops tested this year were edible soybeans, beets, carrots, cucumber, lettuce, onions, peas, spinach, sweet corn, and tomato.

In each case seeds from a single lot were treated by a crop leader at specified dosages and in a uniform manner with three or more seed protectants and distributed to cooperators who conducted germination tests in soil using 5 replications of 100 seeds each.

The 1944 results for the several crops presented by the crop leaders are briefly summarized below:

Edible Soybeans: R. H. Porter obtained reports from 17 tests conducted by 16 cooperators in 14 States on Banzei soybeans treated with Arasan, Spergon, and Formate, each at rates of 1 1/2 and 2 oz. per bushel. The results showed that seed protectants were of some value in about one-third of the tests conducted. Spergon (2 oz.) gave the most consistent increases in emergence. All of the plots in which significant differences occurred were located in States along the Atlantic Seaboard. The tests showed that if conditions are unfavorable for germination one could expect seed protectants to be of value even with seeds of high vitality, and if seeds of low vitality were used the benefits should be greater.

Beets: L. D. Leach summarizes the results of 31 tests conducted in 20 States and one Canadian Province on Detroit Dark Red Beet seeds treated with Arasan (.25%, .50% and 1.00%), Ceresan (1.0%), and Yellow Cuprocide (1.5%.) In most of the tests seed treated with Arasan, Ceresan, or Yellow Cuprocide gave significant increases in number of seedlings compared with untreated seed. Arasan at dosages of 0.5% and 1.0% gave the best results but it was not clear whether the differences between these two dosages justify the use of the 1.0%. The striking benefits from seed treatment in the 1944 beet tests in contrast to the limited benefits obtained in a similar test conducted in 1943 are attributed chiefly to differences in vitality and susceptibility to seed decay in the two seed lots used. These tests again demonstrate the principle that weak seed lots or weak varieties may show greater response to seed protectants than very vigorous seed lots or varieties.

Carrot: B. H. Davis reports from 19 tests conducted in 15 States and 1 Canadian Province on the variety Chantenay treated with Arasan and Spergon at .5% and .75%, Semesan at .42% and red copper oxide and zinc oxide at 1% by weight of seed. All treatments gave increased stands but Arasan gave slightly better results than the other materials.

Cucumber: Under the leadership of S. P. Doolittle cucumbers treated with Arasan (.3%), Yellow Cuprocide (1.0%), and Spergon (0.3%) were tested at 15 locations in 12 States. Beneficial effects from seed protectants were obtained in only about one-fourth of the tests conducted in 1944, whereas similar tests in 1943 gave beneficial effects in practically all cases, indicating that field conditions in 1944 were in general less favorable for seed decay and damping off. Difference in total scores of the treatments used in 1944 indicated that Semesan and Spergon were the most effective materials. Arasan, which in 1943 seemed definitely superior to other treatments, did not give particularly good results in the 1944 tests, while Spergon proved much more effective than in 1943.

Lettuce: Ten tests on lettuce conducted in 8 States using seeds treated with red copper oxide (2%), zinc oxide (2%), Semesan (2%), Arasan (2%), and Spergon (2%), and reported by G. K. Parris, seemed to show that seed treatment is a worthwhile procedure for lettuce. Spergon (2%) showed the most marked benefits in these tests although all treatments used proved superior to the untreated seed.

Onion: A. G. Newhall reports on damping-off control from 11 tests conducted in 8 States and on smut control from 2 tests in 2 States. Approximately one-third of the damping-off tests showed beneficial effect from Arasan (.5% and 1%), Fermate (.5% and 1%), and Semesan (.3% and .5%). No consistent improvement over the untreated seed resulted from Spergon (.5% and 1%), red copper oxide (.5% and 1%), or Vasco 4 (1% and 3%).

Moistening seed with 5% "Methocel" sticker and treating with Arasan, Fermate, or Thiosan (each at 100% and 75% by weight) in 2 tests gave good control of smut in both cases and gave some indication that the 100% dosage was slightly better than the 75% dosage.

Peas: W. T. Schroeder received reports on 53 tests conducted in 22 States and one Canadian Province with Thomas Laxton seed treated with red copper oxide (2 1/4 oz. per bu.), Arasan (1 1/2 and 2 oz.), and Spergon (1 1/2 and 2 oz.). All materials proved beneficial to emergence of peas. Spergon gave the best results. The 2 oz. per bushel dosage appeared to be no more effective than Spergon at 1 1/2 oz.

Spinach: G. K. Parris' summary of results from 36 tests conducted in 25 States and one Canadian Province with seeds treated with Arasan (.25% and .50% by weight), Fermate (.5% and .75%), and zinc oxide (1.5% and 2.0%), again supports our previous conclusion that seed treatment of spinach is a worthwhile practice. Arasan, Fermate, and zinc oxide at the dosages used gave significant increases in stands compared with untreated seed. Of the three materials used, zinc oxide consistently was better than Arasan and Fermate. The results suggested that zinc oxide may be used successfully at a dosage of 1.5% rather than 2.0% as recommended in previous years.

Sweet Corn: B. H. Davis reports that 30 tests conducted on the variety Ioana in 19 States and 1 Canadian Province using Arasan, Spergon, Semesan Jr., and Barbak C at 2 dosages (1.5 and 3.0 oz. per bu.) showed that seed treated with each of the protectants and at each dosage produced a significantly greater number of seedlings than untreated seed. The best results were obtained with Arasan, followed in order of decreased efficiency by Spergon, Semesan Jr., and Barbak C. In each case the higher dosage was better than the lower. The percentage of seedlings classified as "weak" was reduced by all treatments, and again Arasan gave the best results, followed in order of decreased efficiency by Spergon, Semesan Jr., and Barbak C. Thus seed protectants may benefit not only by increasing total emergence but also by reducing the percentage of weaklings in the final stand.

Tomato: S. P. Doolittle and F. S. Beecher received data from 12 tests conducted in 10 States with seeds treated with Spergon (.3% by weight of seed), Arasan (.3%), Semesan (.3%), Yellow Cuprocide (1.5%), New Improved Ceresan (.5%), and a 5-minute dip in a 1-1200 solution of New Improved Ceresan. Improved stands were obtained in only 42% of the tests. Where treatments were beneficial Arasan showed a definite superiority over the other materials but Semesan, Yellow Cuprocide, and New Improved Ceresan also gave good results. Spergon, as in 1943, seemed definitely less effective than the other materials for treating tomato seeds. The New Improved Ceresan was equally good whether used in dust form or as a dip.

SUBCOMMITTEE ON COORDINATION OF VEGETABLE SEED TREATMENT TESTS
C. M. Haenseler, Chairman.